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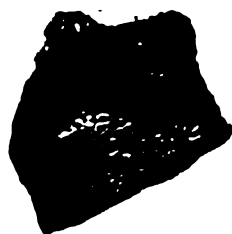
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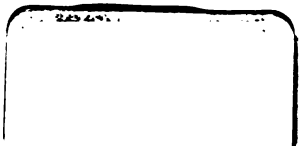
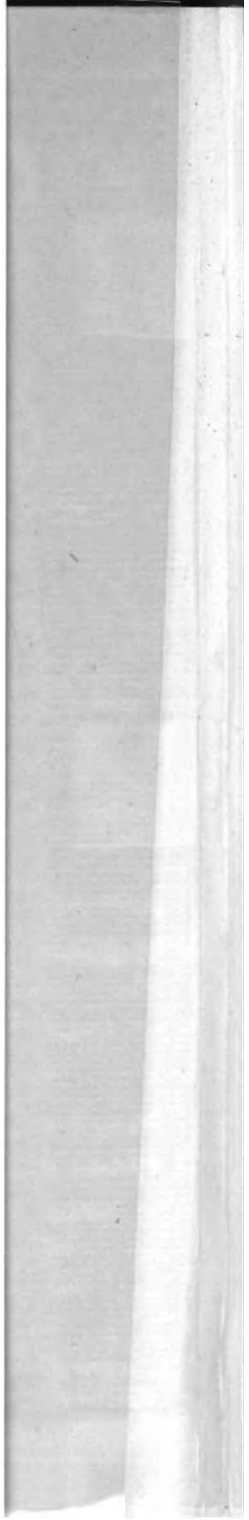
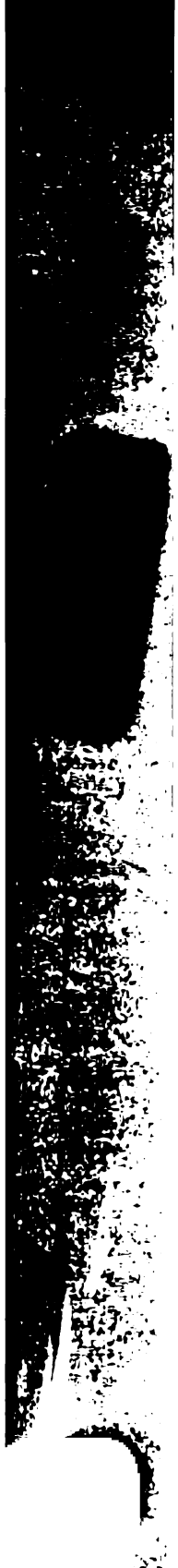
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The scientific publications of the National Museum consist of two series—Proceedings and Bulletins.

The Proceedings, the first volume of which was issued in 1878, are intended primarily as a medium for the publication of original papers based on the collections of the National Museum, setting forth newly acquired facts in biology, anthropology, and geology derived therefrom, or containing descriptions of new forms and revisions of limited groups. A volume is issued annually or oftener for distribution to libraries and scientific establishments, and, in view of the importance of the more prompt dissemination of new facts, a limited edition of each paper is printed in pamphlet form in advance. The dates at which these separate papers are published are recorded in the table of contents of the volume.

The present volume is the thirty-eighth of this series.

The Bulletin, publication of which was begun in 1875, is a series of more elaborate papers, issued separately, and, like the Proceedings, based chiefly on the collections of the National Museum.

A quarto form of the Bulletin, known as the "Special Bulletin," has been adopted in a few instances in which a larger page was deemed indispensable.

Since 1902 the volumes of the series known as "Contributions from the National Herbarium," and containing papers relating to the botanical collections of the Museum, have been published as Bulletins.

RICHARD RATHBUN,
Assistant Secretary, Smithsonian Institution,
In charge of the United States National Museum.

MARCH 24, 1911.

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THE GUSTAVUS VASA FOX COLLECTION OF RUSSIAN SOUVENIRS IN THE UNITED STATES NATIONAL MUSEUM.

By IMMANUEL M. CASANOWICZ,
Of the United States National Museum.

INTRODUCTION.

Gustavus Vasa Fox was born in Saugus, Essex County, Massachusetts, on June 13, 1821. In 1838 he entered the United States Navy as a midshipman and served for eighteen years, taking part in the war with Mexico. Having attained the rank of lieutenant, he resigned in 1856 to engage in a manufacturing business in Lawrence, Massachusetts. In 1861 he was appointed by President Lincoln as Assistant Secretary of the Navy, and held that office until the close of the civil war. In 1866 he was sent by the United States on a special mission to Alexander II, Emperor of Russia, and took an active part in the negotiations which resulted in the acquisition of Alaska by the United States. On his return he resumed his active connection with business in Lowell, Massachusetts. He died in New York City on October 29, 1883.

SPECIAL MISSION TO RUSSIA.

On April 16, 1866, an unsuccessful attempt was made by an assassin on the life of the Emperor of Russia. President Johnson promptly sent a message of congratulation to the Emperor through General Clay, who at that time was the minister to Russia from the United States. In addition to this action, Congress, on motion of Thaddeus Stevens, a Representative from Pennsylvania, adopted on May 10, 1866, the following resolution "relative to the attempted assassination of the Emperor of Russia:"

Be it resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Congress of the United States of America has learned with deep regret of the attempt made upon the life of the Emperor by an enemy of emancipation. The Congress sends greetings to his Imperial Majesty, and to the Russian nation, and congratulates the twenty million of serfs upon the providential escape from danger of the sovereign to whose head and heart they owe the blessings of their freedom.

SEC. 2. *And be it further resolved, That the President of the United States be requested to forward a copy of this resolution to the Emperor of Russia.*

The resolution was approved by President Johnson on May 16, 1866.

It was also decided to send a special envoy on a national vessel to carry the resolution to the Emperor. For this task the Hon. Gustavus Vasa Fox, Assistant Secretary of the Navy, was selected. The mission set out in the two-turret monitor *Miantonomoh*, escorted by the side-wheel steamship *Augusta*, on June 5, 1866, and reached Kronstadt, the port of St. Petersburg and chief naval station of Russia, on August 6. It was the first ocean voyage made by a monitor. On August 8, Mr. Fox was received by Alexander II, to whom he then presented the resolution of Congress. The American mission afterwards visited, by invitation, the cities of Moscow, Nizhni-Novgorod, Kostroma, and Tver, being everywhere received by the authorities, as well as by the populace, with great enthusiasm, several cities conferring on Mr. Fox honorary citizenship.^a

A number of valuable books, atlases, albums, maps, and city plans which were presented to Mr. Fox while he was in Russia were given by him soon after his return, through the Department of State, to the library of the Smithsonian Institution.^b That portion of the gifts received by him in Russia which recently came to the United States National Museum by bequest of Mrs. Virginia L. W. Fox, through her executors, Miss Ellen C. de Q. Woodbury and Mr. Gist Blair, are briefly described in the following notes:

1. *Gold snuffbox*. Oval in shape and exquisitely chased. In the center of the lid is a miniature of the Emperor, Alexander II in full military uniform, surrounded by twenty-six diamonds, while six larger diamonds are set, three on each side, at equal distances from the inner circle. The bottom of the case is ornamented with blue enamel. It was the principal gift of the Emperor to Mr. Fox.^c Height, $1\frac{1}{2}$ inches; length, $4\frac{1}{2}$ inches; width, $3\frac{3}{8}$ inches. (Cat. No. 255168, U.S.N.M.)

2. *Description du sacre et du couronnement de leurs majestés impériales l'empereur Alexander II et l'impératrice Marie Alexandrovna, MDCCCLVI*. (Description of the coronation of their majesties the Emperor Alexander II and the Empress Marie Alexandrovna, 1856.)

^a For an account of the voyage of the American mission to and in Russia see Narrative of the Mission to Russia in 1866 of the Hon. Gustavus Vasa Fox, from the Journal and Notes of J. F. Loubat, edited by John D. Champlin, jr. (New York, 1873); and Russian account of the official mission to Russia of Hon. G. V. Fox in 1866, translated by S. N. Buynitzky for the Department of State (Washington, 1867).

^b Compare J. F. Loubat, Narrative of the Mission to Russia in 1866, etc., pp. 420-421.

^c "Snuffboxes are given by sovereigns, in lieu of decorations, to those who can not receive the latter. There are three grades: Plain gold boxes, boxes set with diamonds, and those having both diamonds and the sovereign's miniature. The latter are given only to persons of the highest distinction." J. F. Loubat, Narrative of the Mission to Russia, p. 359.

Pages 125, printed on heavy bristol board, with 20 plates in chromolithography and 32 illustrations in the text, showing the portraits of the imperial family, the streets and churches of Moscow, where the coronation took place, the processions and festivities celebrated on the occasion, etc. Bound in half morocco, stamped on the back in gold with the crown, scepter, and globe. Height, 36 inches; width, 27 inches. (Cat. No. 255171, U.S.N.M.)

3. *Drevnosti rossiyskavo gosudarstva. Isdannyya po vysochayshemu poveleniyu gosudara imperatora Nikolaya I.* (Antiquities of the Russian Empire. Published by the august order of the Emperor Nicholas I.) Four folio volumes of chromolithographic plates. Bound in half russian leather, pressed in gold, with gilt edges. In the center of the left cover of each volume is stamped in gold in the French language: "Presented by His Majesty, the Emperor Alexander II of Russia to the Honorable G. V. Fox, August, 1866." Volume 1, series 1, ecclesiastical objects—ikons, crosses, church vessels, and patriarchal vestments, 112 plates; volume 2, series 2, ornaments and vestments of the czars, 101 plates; volume 3, series 3, war paraphernalia—banners, arms, armor, carriages, trappings, and harness, 147 plates; volume 4, series 4, portraits and costumes, 37 plates; series 5, table plate, 72 plates; series 6, views of some church and palace buildings and their ornaments, 39 plates. Height, 21 inches; width, 15½ inches. (Cat. No. 255172, U.S.N.M.)

4. *Description ethnographique des peuples de la Russie.* (Ethnographic description of the peoples of Russia.) By T. de Pauly. Published on the occasion of the one thousandth anniversary of the Russian Empire. St. Petersburg, 1872. Text and chromolithographic plates. Contents: The Indo-European peoples of Russia, pages 154, with 23 plates; Uralo-Altaic peoples, pages 78, with 22 plates; peoples of eastern Siberia, pages 13, with 4 plates; peoples of Russian America, pages 15, with 4 plates. Supplemented by a plate showing the principal craniological types of Russia, an ethnographic and statistical table, and an ethnographic map of the Russian Empire. Bound in morocco, pressed in gold, with gilt edges. Height, 21½ inches; width, 16½ inches. Presented by the Emperor Alexander II to Mr. Fox. (Cat. No. 255174, U.S.N.M.)

5. *Musee de Tzarskoe-selo du collection d'armes.* (The museum of arms in Tsarskoye Selo.)^a By F. Gille. Two folio volumes of 180 lithographic plates, with explanatory text. Bound in half morocco, with the imperial arms of Russia stamped in gold on the covers. Height, 22½ inches; width, 17½ inches. Presented by Emperor Alexander II to Mr. Fox. (Cat. No. 255173, U.S.N.M.)

^a This palace is about 15 miles south of St. Petersburg and is the summer residence of the court.

6. *The Romanow-Gallery in the imperial winter palace. Photographic portraits of the sovereigns of Russia. St. Petersburg, 1866.* Album of cloth, stamped with the imperial arms, containing 24 cartes de visite of the sovereigns of the house of Romanov and their consorts, from Michael Feodorovich (1613-1645) to Alexander II (1855-1881) and his wife Marie Alexandrovna. Height, 6½ inches; width, 5 inches. (Cat. No. 255661, U.S.N.M.)

7. *The Museum of the Imperial Hermitage. Photographic reproductions of the most eminent paintings, statues, etc. Presented by order of his Imperial Majesty Alexander II to the officers of the fleet of the United States of America. St. Petersburg, August, 1866.* A book-shaped case, bound in half russian leather, stamped in gold with the imperial arms, containing 50 photographic reproductions of paintings of the Italian, Spanish, Dutch, and English schools, and Greek sculptures. Height, 11 inches; width, 9 inches. (Cat. No. 255674, U.S.N.M.)

8. *Diploma of honorary citizenship conferred by the city of St. Petersburg on the Honorable Gustavus Vasa Fox.* The diploma, done in water colors, is engrossed on heavy bristol board, measuring 18 by 22½ inches. The border, in the Byzantine style, is decorated with the following representations: In the center of the top are the arms of the city of St. Petersburg, two anchors, and a scepter crossed, with the Slavonic letter "A," the initial of the Emperor's name, on each side, surmounted by crowns. To the right are the American flag and the Russian naval flag crossed; to the left, in the same manner, again the American flag and the Russian imperial standard. In the right corner is the Slavonic shield of the Middle Ages. Underneath, the imperial arms of Russia, a double-headed eagle under a crown. Next below is the Russian cross. Under it a medal with the bust of Alexander II, bearing the inscription "Liberator." Underneath are allegorical attributes of the arts and sciences. On the left side, at the top, is the crown of cap of Monomachus,^a worn by the Russian rulers until the time of Peter the Great (1696-1724). Below it are the imperial arms and the cross, beneath which is a medal with the bust of Peter the Great, with the inscription, "Reformer," beneath which again are the allegorical attributes of commerce. In the center at the bottom is the seal of the city of St. Petersburg, with an engraving of St. Isaac's Cathedral on the left and of the Exchange on the right.

^a In 1114 the Greek Emperor, Constantine Monomachus, sent Vladimir II, Grand Duke of Kiev, 1053-1125, from Constantinople as gifts a cross made of the wood of the true cross, an imperial crown, a splendid dalmatic, and a gold chain. Vladimir took the name of Monomachus in compliment to the Emperor, and assumed the title of Czar of Grand Russia. These presents from the Greek Emperor are still used in the coronation of the Russian Emperors.

The diploma proper, in the Russian language and Slavonic script, reads as follows:

The Commonalty of the city of St. Petersburg, with the permission of his most gracious Imperial Majesty,^a has nominated G. V. Fox, Ambassador of the Congress and Assistant Secretary of the Navy of the United States of North America, and Member of the Cabinet of Washington, an honorary citizen of the city of St. Petersburg, as a sign of special respect for him, as the Representative of the People of North America, through whom they expressed their most sincere sympathy toward Russia and her Emperor, and in remembrance of the feelings with which this declaration was received by the city of St. Petersburg.

St. Petersburg, August 3, 1866.

The Mayor of St. Petersburg: N. POGREBOV.

Seniors: A. ZABLOTZKY, DESSIATOVSKY, NIKOLAY

BYKOV, SV. AVERIN.

Secretary of the City: A. TREVILLE.

(Plate 1, Cat. No. 255169, U.S.N.M.)

9. *Casket of Siberian malachite.* Containing the diploma of honorary citizenship of the city of St. Petersburg. Inlaid with ornaments of gilt bronze and the arms of the city of St. Petersburg, two anchors, and a scepter crossed, in the center of lid. Lined inside with blue velvet. Height, 5 inches; length, 26 inches; width, 21 inches. (Plate 2, Cat. No. 255164, U.S.N.M.)

10. *Diploma of honorary citizenship conferred by the city of Moscow on the Honorable Gustavus Vasa Fox.* This diploma is done in water colors on heavy board and is 36 by 30 inches in size. The border is architectural in the Byzantine style. It comprises a broad base, inclosing a view of the Kremlin, the famous citadel of Moscow, and the bridge leading to it; a tower and spire on each side, which are connected at the top by an ornamental arch, with shadowy battlements behind. At the base of each spire is a medallion; that on the left representing the churches of the Kremlin; that on the right, the bronze monument of Minin and Pozharsky,^b near the Kremlin. In the center of the arch are the arms of the city of Moscow, St. George slaying the dragon,^c and surmounting the arch, as well as the two spires, are the imperial arms, the double-headed eagle under a crown.

^a For the bestowing of honorary citizenship, the highest distinction in Russia, unanimity of the municipality and permission and authorization of the Emperor are required.

^b When the Poles under Wladislas, in 1610, invaded Moscow, Minin, a butcher of Nizhni-Novgorod, assembled volunteers, with whose aid the magnate (boyar) Dmitri Mikhailovich Pozharsky, succeeded in driving out the invaders in 1612. On the monument Minin is represented with upraised arms, calling on Pozharsky to deliver his country from the Poles.

^c This was the standard of the Grand Dukes of Russia until the marriage of Ivan III the Great, Grand Duke of Moscow (1462-1508), with Sophia, the daughter of the last Greek Emperor. It is still seen in the center of the present imperial arms of Russia.

The diploma, in the Russian language and in Slavonic script, reads as follows:

GUSTAVUS VASA FOX, who presented to his Imperial Majesty the congratulations of the North American Congress on the occasion of deliverance from the danger which menaced His Majesty and all the Russian people, by the resolution of the Municipal Council of Moscow, approved by His Majesty on the twenty-fifth of August, 1866, and in token of the particular regard of the citizens of Moscow for him as a worthy representative of the great North American people, friendly to Russia, is acknowledged Honorary Citizen of Moscow.

The Mayor of Moscow: Prince VLADIMIR TCHEKASSKY.

Councilmen:

Prince DMITRY GALITZIN.

CONSTANTINE GILDBACH.

VASILII BOSTANZHOGLO.

VASILII TORGASHEV.

JACOB BUSHANOV.

Assistant Councilmen:

MICHAEL BIBIKOV.

VLADIMIR VIKHNYAKOV.

IVAN BAKLANOV.

ALEXANDER GORBUNOV.

GREGORY ORLOV.

The diploma is set in a richly carved wooden frame, likewise architectural, resembling in style the border of the diploma, with the arms of Moscow and of the United States combined in the center at the top. Height of the frame, 65 inches; width, 34½ inches. (Plate 3, Cat. No. 255166, U.S.N.M.)

11. *Portfolio which originally contained the diploma of honorary citizenship of the city of Moscow.* Made of wooden boards, 36 by 28 inches in size, covered with a single piece of russet leather, richly embossed by a plate of the full size, and ornamented with corners, bosses, and clasps of silver open work in Byzantine style. In the center of the left cover is set a silver plate, 12 inches square, containing in a circle, in Slavonic letters, the name "Moscow" in chased, open, and repoussé work. Lined inside with white moreen silk. (Plate 4, Cat. No. 255162, U.S.N.M.)

12. *Memorial from Cherepovetz.* Representation of a memorial erected by the brothers Milyutin in Cherepovetz, a city in the government of Novgorod, in remembrance of the visit of the American special mission in Russia and of its receiving a deputation of emancipated peasants who went from Cherepovetz to St. Petersburg (a distance of more than 400 miles) to express their thanks to the Americans for the sympathy and esteem shown to the Russian Emperor. The inscription describes the occasion and the object of the coming of the American mission, and the addresses delivered by the leader of the deputation from Cherepovetz and by the Honorable G. V. Fox on the occasion of their meeting. In the center is a representation of the American flag, which was presented by Mr. Fox to the deputation. On each side is a medallion flanked by the American and Russian flags; that on the right representing the monitor *Miantonomoh* in the roadstead of Kronstadt, that on the left, the scene of

presenting bread and salt by the deputation to Mr. Fox.^a The frame is carved in Russian wood of different qualities and kinds from a design by Col. N. Mussard. The carving was done in twelve days by a Russian peasant, Leontyev. The objects represented on the frame are, from top to bottom, as follows: The Byzantine cross; the chalice; a star on each side; a Russian salt cellar in form of a chair; a loaf of bread; a Russian towel on supporters; the arms of the government of Novgorod: two bears, erect, facing one another, with the emblems of the sea between them and fishes underneath; the dove with an olive branch, and on both sides ears of corn, the emblems of fertility. Height, 57 inches; width, 32½ inches. (Plate 5, Cat. No. 255165, U.S.N.M.)

13. *Silver salver.* Finely chased. Engraved with the Russian letters "S M G," surmounted by a crown, and the date July 5, 1865. Length, 24½ inches; width, 15 inches. (Cat. No. 255168, U.S.N.M.)

14. *Silver-gilt salt cellar* in form of a chair. Chased and open work. Engraved with the Russian letters "S M G," surmounted by a crown, and the date July 5, 1865. Height, 4⅞ inches; length, 3⅝ inches; width, 2¾ inches. (Cat. No. 255163, U.S.N.M.)^b

15. *Portfolio of red velvet, lined inside with yellow moreen silk.* In the center of the left cover is set in an oval painting in water colors, 5¾ inches by 4¾ inches in size, representing the arms of Kronstadt, the principal naval fortress and port of Russia, consisting of an escutcheon divided into two equal parts (*per pale*), red on the right side and azure on the left. On the left side is a lighthouse in silver, on the right a black kettle on green.^c Above the escutcheon rise the battlements of a fortress, surmounted by the imperial arms of Russia. On each side are yellow flags bearing the imperial arms. Height, 21½ inches; width, 16½ inches. (Plate 6, Cat. No. 255175, U.S.N.M.)

16. *Miantonomoh Galop for piano.* Dedicated to Capt. G. V. Fox by Heinrich Fuerstnow, musical director in Pavlovsk. The title page shows the monitor *Miantonomoh* with the American flag. Pages 8, quarto, in portfolio of blue velvet, with gold pressing, lined with white moreen silk. Height, 13¾ inches; width, 11 inches. (Cat. No. 255645, U.S.N.M.)

17. *Popuri iz Amerikanskikh narodnykh pyesney.* (Potpourri of American songs.) Arranged for grand orchestra by Frederick Lund, musician of the imperial orchestra. Manuscript, pages 27, quarto,

^a Distinguished visitors and guests are welcomed in Russia with bread and salt, the "staff of life," as emblems of hospitality.

^b These two vessels were probably used for the presentation of bread and salt.

^c It is said that Peter the Great, at the time of the founding of Kronstadt, picked up a broken iron kettle on the island, where it had been left probably by fishermen, and in commemoration of the circumstance gave it to the new city for its arms.

in portfolio of cloth, stamped in black and gold. Height, 10 $\frac{1}{4}$ inches; width, 15 $\frac{1}{4}$ inches. (Cat. No. 255640, U.S.N.M.)

18. *A manual of Russian conversation*, containing (1) the Russian alphabet; (2) a selection of words frequently used in conversation; (3) examples of the use of verbs in connection with other parts of speech; (4) phrases frequently used in conversation; (5) dialogues; (6) outlines of Russian grammar; (7) a comparative table of Russian and English coins, weights, and measures; (8) a list of the principal technical terms for the use of civil engineers, mechanics, etc. By A. Paucker, English teacher in the Imperial Alexander Lyceum. St. Petersburg, 1866. This manual was especially prepared for the benefit of the members of the American mission. Pages 200, 12mo. Bound in Russian russet leather, stamped in gold with the American and Russian flags, with gilt edges. Height, 6 $\frac{1}{2}$ inches; width, 5 inches. (Cat. No. 255660, U.S.N.M.)

19. *Étiquette observée a la cour impériale de Russie*. (The etiquette observed at the imperial court of Russia.) Bound in half roan. Height, 11 $\frac{1}{4}$ inches; width, 8 $\frac{1}{4}$ inches. (Cat. No. 255649, U.S.N.M.)

20. *Gold medal, commemorating the edict of the emancipation of the serfs by Emperor Alexander II*. On the obverse a noble and a peasant clasp hands in front of the Emperor, who places his hands upon their shoulders, standing between a palace and a peasant's cabin, with the date of the edict, February 19, 1861; on the reverse, the Russian cross, with the words in Slavonic script: "Cross thyself, O orthodox nation, and invoke the divine blessing upon thy work of liberation!" Diameter, 2 $\frac{1}{4}$ inches. (Plates 7 and 8, fig. 1, Cat. No. 255159, U.S.N.M.)

21. *Silver medal, commemorating the one hundredth anniversary of the accession to the throne of Catharina II*. On the obverse is the bust of the Empress, with her name and title: "Catharina II, Empress and Autocrat of Whole Russia;" on the reverse is a female figure standing, holding in the right hand a cross and pointing the left to a seated female figure who holds an infant in her arms, with the words "Ye shall live also" (John xiv, 19). Underneath is the date of Catharina's accession, September 1, 1762. Diameter, 2 inches. (Plates 7 and 8, fig. 2, Cat. No. 255161, U.S.N.M.)

22. *Silver medal, commemorating the one hundredth anniversary of the founding of the Moscow Foundling Asylum*. On the obverse are the busts of Emperor Alexander II and Empress Marie Alexandrovna, surmounted by a cross, with their names and the date, 1863. On the reverse is a seated female figure, holding in her raised right hand a burning heart and with her left clasping an infant to her bosom, while two other children are leaning against her knees. In the background are seen the buildings and the church of the asylum. The inscription reads: "Whoever shall receive one of such children in my

name, receiveth me" (Mark ix, 37), and says that the asylum was founded by Catharina II. (1762-1796) September 1, 1763. Diameter, 2 inches. (Plates 7 and 8, fig. 3, Cat. No. 255168, U.S.N.M.)

23. *Bronze medal, commemorating the one hundredth anniversary of the death of Mikhail Vasilievich Lomonossov, Russian poet, philologist, and scientist (1711-1765).* On the obverse is the bust of the poet with his name and the dates of his death, April 4, 1765, and of the celebration of the centennial anniversary in Nizhni-Novgorod, April 4, 1865. On the reverse, a man and a boy are standing on the shore holding a net by the side of fishing boats, with the inscription: "Leave alone, O boy, the fisherman! Other nets, other tasks await you. Thou wilt catch minds, and be a helper of the Czars!" This legend, probably taken from one of Lomonossov's poems, and the scene depicted on the medal refer to the fact that the poet was the son of a fisherman and was himself destined for this vocation, but ran away from his father when he was 17 years old and became a scholar and writer, thus earning the title of "father of Russian grammar and literature." Diameter, 2 inches. (Plates 7 and 8, fig. 4, Cat. No. 255639, U.S.N.M.)

24. *Panorama, in chromolithography, of the city of St. Petersburg, showing the principal buildings and monuments.* Paper mounted on cloth. Length, 28 feet 4 inches; height, 8½ inches. (Cat. No. 255643, U.S.N.M.)

25. *Panorama of the city of St. Petersburg.* The same as the above, No. 255643. Printed on cloth. Length, 24 feet; height, 7½ inches. (Cat. No. 255644, U.S.N.M.)

26. *Opisanie Isaakievskavo sobora v S. Peterburgye.* (Description of St. Isaac's Cathedral in St. Petersburg.) By Reverend V Seraphimov and Inspector M. Formin. St. Petersburg, 1865. The St. Isaac's Cathedral is considered as the finest church building in northern Europe, and ranks in size, cost, and importance next after St. Peter's in Rome, and St. Paul's in London. It occupies the site of the original wooden building erected by Peter the Great, which was dedicated to St. Isaac of Dalmatia, because the city of St. Petersburg was founded on the day sacred to him. The present building, entirely of marble and granite, was begun in 1819 by Alexander I and consecrated in 1858 by Alexander II. It was designed by M. Montferrand, a French architect. Like other orthodox churches it is in form of a Greek cross with four equal sides, surmounted in the center with a cupola of cast and wrought iron, overlaid with gold, which reaches a height of 102 meters, and is accompanied by four smaller ones at the four principal angles of the central square. The four octostyle porticoes are constructed each of forty-eight monolithic columns of Finnish granite, 14 meters high, with Corinthian capitals in bronze. Each of the porticoes has three flights of granite

steps, each entire flight being chiseled from a single block. The ikonostas (image stand, the partition between the sanctuary and the main body of the church) is divided up by ten colossal malachite and two lapis-lazuli columns, and is decorated with magnificent mosaic pictures. The central door in it, called the "royal gate," is of bronze, and is 23 feet in height by 15 feet in width. There is a great abundance, inside and outside of the building, of decorative sculpture in bronze and various kinds of stone. Pages 91, octavo, with 5 lithographic plates. Bound in cloth. Height, 11 inches; width, 5 inches. (Cat. No. 255647, U.S.N.M.)

27. *Otchet imperatorskoy publichnoy biblioteki za 1863 god.* (Report of the imperial public library in St. Petersburg for 1863.) By the librarian Delyanov. Pages 186, octavo. The same for 1864, pages 115. Bound in cloth. Height, 9½ inches; width, 6½ inches. (Cat. No. 255648, U.S.N.M.)

28. *Catalogue des publications de la bibliothèque impériale publique de Saint Pétersbourg, depuis sa foundation jusqu' en 1861.* (Catalogue of the publications of the imperial public library of St. Petersburg, from its foundation till 1861.) Pages 38, small quarto. Bound in cloth. Height, 9¼ inches; width, 7¼ inches. (Cat. No. 255670, U.S.N.M.)

29. *Morskoy Sbornik.* (Navy Journal.) Volume 85, No. 8, August, 1866, and volume 115, No. 8, August, 1871. St. Petersburg. Presented by the editor Vsevolod Melnitzky to Mr. Fox. Bound in half roan. Height, 9¼ inches; width, 6¾ inches. (Cat. Nos. 255665-6, U.S.N.M.)

30. *Ustav i pravila S. Peterburgskavo rechnavo yachtkluba.* (Constitution and by-laws of the River Yacht Club of St. Petersburg.) St. Petersburg, 1865. Pages 136, 12mo., with 4 chromolithographic plates showing the flags of the club. Bound in morocco, with gilt edges. Mr. Fox was elected an honorary member of the club. Height, 5¼ inches; width, 3¼ inches. (Cat. No. 255656, U.S.N.M.)

31. *Ustav russkavo Kupyecheskavo obshchestva dlya vzaimnavo vspomozheniya.* (Constitution of the Russian Merchants' Club for Mutual Aid.) St. Petersburg. Pages 55, 12 mo. Bound in brown velvet, stamped in gold, with gilt edges. Height, 6¼ inches; width, 5 inches. Mr. Fox was chosen an honorary member of the club. (Cat. No. 255657, U.S.N.M.)

32. *Katalog russkikh knig Kronshtadskoy morskoy biblioteki.* (Catalogue of the Russian books in the navy library of Kronstadt.) Pages 250, octavo. Bound in morocco, with gilt edges. Height, 8½ inches; width, 6¼ inches. (Cat. No. 255667, U.S.N.M.)

33. *Kronshtadskiy Vyestnik.* (Kronstadt Herald.) Numbers 64-101, 1866, containing the Russian account of the American special mission to Russia in 1866. (Cat. No. 255640, U.S.N.M.)

34. *Vidy nikolayevskoy zhelyeznoy dorogoy.* (Views of the Nicholas Railway.) Fifty-six photographic views of the railway between St. Petersburg and Moscow (403 miles long), called the Nicholas Railway in honor of Emperor Nicholas I (1825–1855), under whose auspices it was built. Contained in a book-shaped case of morocco, stamped in gold. Height, 16½ inches; width, 20½ inches. (Cat. No. 255683, U.S.N.M.)

35. *Moskva. Podrobnoë istoricheskoe i arkheologicheskoe opisanie goroda.* (Moscow. A detailed historical and archeological description of the city.) By I. M. Snegirev. Volume I. Moscow, 1865. Pages lxxviii and 210, quarto; with 1 chromolithographic plate, showing the arms of the city of Moscow, St. George slaying the dragon. Bound in russian leather, stamped in gold, with gilt edges. Height, 12 inches; width, 9 inches. (Cat. No. 255675, U.S.N.M.)

36. *Prilozheniya k pervomu tomu Moskvu.* (Supplement to the first volume of the description of Moscow.) Consisting of a plan and two panoramas of the city of Moscow, in a portfolio of russian leather. Height, 14½ inches; width, 11½ inches. (Cat. No. 255679, U.S.N.M.)

37. *Sacristie Patriarchale dite Synodale de Moscou.* (The patriarchal, called synodal, sacristy of Moscow.) A description of the ecclesiastical vestments and vessels preserved in the patriarchal or synodal vestry at Moscow. By Sabas, Bishop of Mozhaïsk. Moscow, 1865. Pages 32, quarto, with 15 lithographic plates. Bound in russet leather in imitation of bark, with gilt edges. Height, 12½ inches; width, 9½ inches. (Cat. No. 255650, U.S.N.M.)

38. *Paleograficheskie snimki s grecheskikh i slavyanskikh rukopisy moskovskomu synodalnomu biblioteki, vi–xvii vyeka.* (Paleographical specimens of Greek and Slavonic manuscripts, from the sixth to the seventeenth centuries, in the Synodal library at Moscow.) By Sabas, Bishop of Mozhaïsk. Moscow, 1863. Pages 46, quarto, with 60 plates. Bound in russet leather in imitation of bark, with gilt edges. Height, 12½ inches; width, 9½ inches. (Cat. No. 255651, U.S.N.M.)

39. *Views of the Agricultural and Forest Academy of Peter the Great, near Moscow. August 13, 1866.* Three photographic views of the agricultural and forest academy founded by Peter the Great near Moscow. Contained in portfolio of cloth. Height, 17½ inches; width, 24½ inches. (Cat. No. 255686, U.S.N.M.)

40. *Tzarskiya palaty.* (The imperial palaces.) Thirteen chromolithographic views of the new imperial palace in the Kremlin at Moscow. By A. Prev, with a description in Russian and French. By A. Weltman. Moscow, 1851. Contained in a portfolio of half roan. Height, 25 inches; width, 18 inches. (Cat. No. 255687, U.S.N.M.)

41. *Vidy pamyatnika tysyachalyetno rossii.* (Views of the monument erected, in 1862, at Novgorod, to commemorate the one thou-

sandth anniversary of the Russian Empire.) Fourteen photographs, in a book-shaped case of morocco. Height, 9½ inches; width, 12½ inches. (Cat. No. 255676, U.S.N.M.)

42. *Two photographs representing views of Kostroma*, the birthplace of the Romanovs, the present dynasty on the Russian throne, in a folder of half roan. Height, 11½ inches; width, 9 inches. (Cat. No. 255672, U.S.N.M.)

43. *Istoricheskoe opisaniie Kostromskavo ipatskavo monastyra*. (Historical description of the Ipatyev monastery at Kostroma.) By Archpriest Mikhail Diev. Moscow, 1858. The Ipatyev monastery dates from the fourteenth century. Michael Feodorovich, the first of the Romanovs (1613–1645), lived there when he was called to the Russian throne. Pages 90, octavo. Bound in paper in imitation of white moreen silk, with gilt edges. Height, 9 inches; width, 6½ inches. (Cat. No. 255668, U.S.N.M.)

44. *Zhivopisny Karamzin ili russkaya istoriya v kartinakh*. (Pictorial Karamzin, or history of Russia in pictures.) By Andrew Prev. St. Petersburg, 1836–1844. One hundred and sixty illustrations, with explanatory text to the History of the Russian Empire, by Nicholas Mikhailovich Karamzin (1765–1826), which was first published in eleven volumes, St. Petersburg, 1816–1826. Issued in eleven fascicles and inserted in three ornamental folders of cardboard. Of folder 2 there is a duplicate in form of a bound volume. Height, 9½ inches; width, 7 inches. (Cat. No. 255646, U.S.N.M.)

45. *Russkiy istoricheskii albom*. (Russian historical album.) Containing 261 autographs, in various languages, of prominent personages, from the fifteenth to the nineteenth centuries. Moscow, 1855. Pages 44, quarto. Bound in cloth. Height, 13½ inches; width, 10½ inches. Presented by Prince A. Sherbalov, mayor of Moscow, to Mr. Fox. (Cat. No. 255677, U.S.N.M.)

46. *The Russian Orthodox Church. A treatise of her origin and life*. By Archpriest Bassanoff. Translated by Rev. N. Bjerring, priest of the Orthodox Eastern Church. New York, 1873. Pages 44, octavo. Paper. Height, 7½ inches; width, 5 inches. (Cat. No. 255655, U.S.N.M.)

47. *Proyekt pravoslavnavo khrama vo imya Josifa Georgiya Zosimu*. (Plan of an orthodox church in honor of St. Joseph George Zosimus.) By Architect Nicholas Khokhlov. April 4, 1866. Consisting of 4 chromolithographs in a portfolio of morocco, stamped in gold, lined with brown moreen silk. Height, 24½ inches; width, 18½ inches. (Cat. No. 255684, U.S.N.M.)

48. *Izslედovaniya o sostoyanii rybolovstva v Rossii*. (Investigation of the condition of the fishery industry in Russia.) Seven quarto volumes. Published by the Ministry of Imperial Domains. St. Petersburg, 1860–1863. Contents: Volume 1, the fisheries in the

Chud and Pskov lakes and the Baltic Sea, pages 97, with a map of the Chud and Pskov lakes; volume 2, fisheries in the Caspian Sea, pages 213, with two maps of the Astrakhan waters and of the southern region of Transcaucasia; volume 3, description of the fisheries in the Ural, pages 106, with one plate; volume 4, technical description of the fisheries of the Caspian Sea, pages 141; volume 5, statistical tables of the fisheries of the Caspian Sea, pages 150; volume 6, the fishing and hunting industries in the White and Ice seas, pages 250, with two maps of the North Atlantic and Norway, respectively; volume 7, technical description of the fishing and hunting industries of the White and Ice seas, pages 108. Bound in half roan. Height, 12½ inches; width, 9¼ inches. (Cat. No. 255652, U.S.N.M.)

49. *Risunki k izslyedovaniyu Kaspiyskavo rybolovstva.* (Drawings to the investigation of the fisheries of the Caspian Sea.) Chromolithographic representations of boats, nets, and other appliances used in the fishing industry. Published by the Ministry of Imperial Domains. St. Petersburg, 1861. Bound in half roan, stamped in gold. Height, 18½ inches; width, 14 inches. (Cat. No. 255652, U.S.N.M.)

50. *Atlas économique-statistique de la Russie d'Europe.* (Economic statistical atlas of European Russia.) Explanatory text. Published by the Ministry of Imperial Domains. St. Petersburg, 1857. Pages 104, octavo. Bound in half roan. Height, 9½ inches; width, 6½ inches. (Cat. No. 255669, U.S.N.M.)

51. *La mine de graphite de Sibérie découverte en 1847.* (The graphite mine of Siberia, discovered in 1847.) By M. J. P. Alibert. Paris, 1865. Pages 134, octavo, with 6 plates. Bound in half morocco. Height, 11 inches; width, 7¼ inches. Presented by the author to Mr. Fox, August 29, 1866. (Cat. No. 255366, U.S.N.M.)

52. *Sobranie russkikh narodnykh pyesen.* (A collection of Russian popular songs with variations for piano.) By Alexander Dyubyuk. Moscow, 1855. Quarto. Bound in russian leather, stamped in gold. Height, 13 inches; width, 10½ inches. Presented by Nicholas Shcherbin to Mr. Fox. (Cat. No. 255681, U.S.N.M.)

53. *Narodnyya russkiya pyesni.* (Russian popular songs for solo, chorus, and piano.) Arranged by Ivan Rupin. Dedicated to the Empress Marie Alexandrovna. Quarto. Bound in russian leather, stamped in gold. Height, 10½ inches; width, 13½ inches. Presented by Nicholas Shcherbin to Mr. Fox. (Cat. No. 255682, U.S.N.M.)

54. *Eight photographic views of Russian landscapes in portfolio of cloth.* Presented by photographer M. Tulinov to Mr. Fox. Height, 18½ inches; width, 25 inches. (Cat. No. 255685, U.S.N.M.)

55. *Twenty-three photographic views of churches, palaces, institutions, monuments, etc., in various parts of Russia.* (Cat. No. 255686, U.S.N.M.)

56. *Six plates from the Arkhitekturny Vvestnik* (Journal of Architecture). (1) Fragments of ancient decorative paintings in churches near Novgorod (chromolithograph); (2) plan of the cathedral of St. Sophia in Novgorod (chromolithograph); (3) palace of Madame E. M. Baturlin in St. Petersburg (woodcut); (4) Tartar mosaics (chromolithograph); (5) palace of justice at Baku (woodcut); (6) marks of Slavonic manuscripts (chromolithograph). Bound in cardboards. Height, 14 inches; width, 10 $\frac{1}{4}$ inches. (Cat. No. 255678, U.S.N.M.)

57. *Russian manuscript containing ten religious and patriotic essays*, with a preface containing an address to the American people, by Alexander Korobov. Bound in half roan. Height, 10 $\frac{1}{4}$ inches; width 8 $\frac{3}{4}$ inches. (Cat. No. 255673, U.S.N.M.)

58. *Russian account of the official mission to Russia of Hon. G. V. Fox in 1866*. Translated by S. N. Buynitzky. Washington, 1867. Contains chiefly a translation of the articles in the Kronstadt Herald relating to the American mission. Pages 62, octavo. Bound in morocco, stamped in gold. Height, 9 inches; width, 5 $\frac{1}{4}$ inches. (Cat. No. 255664, U.S.N.M.)

59. *Narrative of the Mission to Russia in 1866 of the Hon. Gustavus Vasa Fox, Assistant Secretary of the Navy*. From the journal and notes of J. F. Loubat. Edited by John D. Champlin, jr. New York, 1873. Pages 444, octavo. With 13 portraits. Bound in cloth, with gold pressings. Height, 9 $\frac{1}{4}$ inches; width, 7 $\frac{1}{4}$ inches. (Cat. No. 255303, U.S.N.M.)

60. *Package of newspaper clippings* relating to the American mission to Russia under Hon. G. V. Fox. (Cat. No. 255642, U.S.N.M.)

OTHER OBJECTS INCLUDED IN THE FOX COLLECTION.

61. *Complimentary banquet given by the city council of Boston to Rear-Admiral Lessoffsky and the officers of the Russian fleet at the Revere House, June 7, 1864*. Contains an account of the visit of the Russian squadron under Rear-Admiral Lessoffsky in American waters in 1864 and the festivities given in its honor in Boston. Boston, 1864. Pages 58, octavo. Paper. Height, 9 $\frac{1}{4}$ inches; width, 5 $\frac{1}{4}$ inches. (Cat. No. 255662, U.S.N.M.)

62. *His Imperial Highness the Grand Duke Alexis in the United States of America during the winter of 1871-72*. Contains the itinerary of the Grand Duke Alexis, fourth son of Emperor Alexander II in the United States, which extended from November 20, 1871, to February 22, 1872. Cambridge, 1872. Pages 223, octavo. Bound in morocco, richly stamped in gold, with gilt edges. Height, 10 $\frac{1}{4}$ inches; width, 7 inches. (2 copies, Cat. No. 255671, U.S.N.M.)

63. *Package of newspaper clippings* relating to the visit of Grand Duke Alexis in the United States during the winter of 1871-72. (Cat. No. 255641, U.S.N.M.)

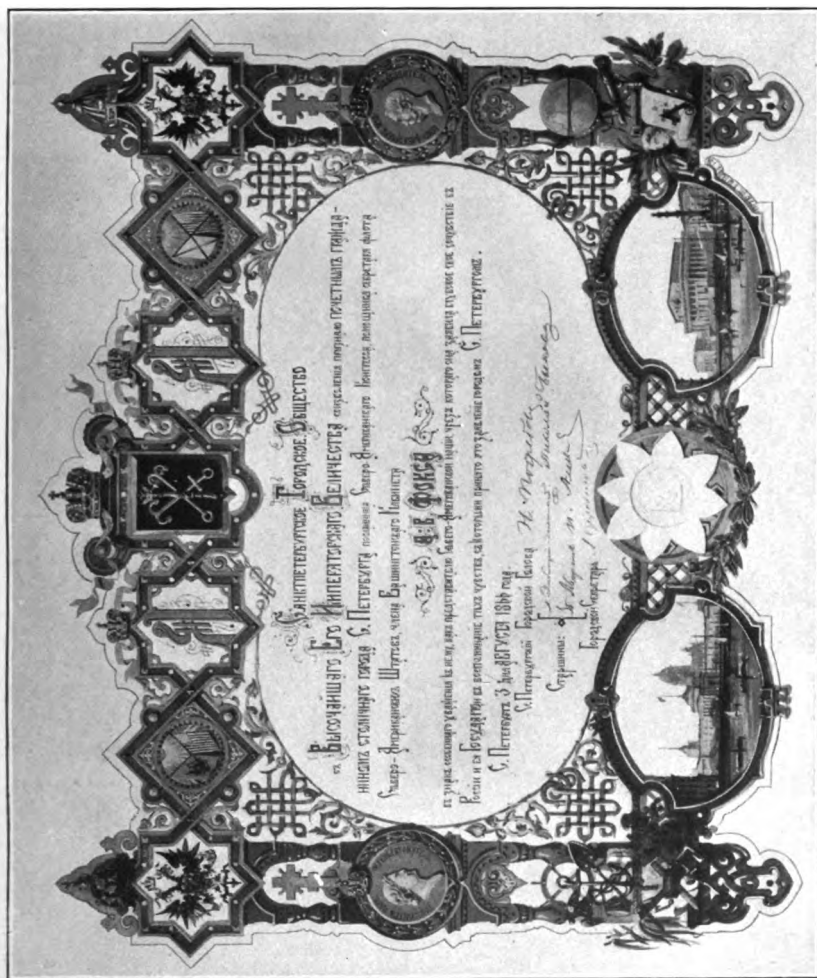
64. *Svenska Nationaltrågter*. (Swedish National Costumes.) Album of 12 chromolithographs. Bound in leather. Height, 6 inches; width, 5 inches. (Cat. No. 255658, U.S.N.M.)

65. *Sveriges Historia*. (Swedish History.) One part. By Oskar Montelius, Hans Hildebrand, Oskar Alin, Martin Weibull, Rudolf Tengberg, and John Hellstenius. Stockholm, 1877. Pages 96, octavo. Paper. Height, 9½ inches; width, 6½ inches. (Cat. No. 255659, U.S.N.M.)

66. *Bronze medal commemorating the fiftieth anniversary of the Societa Ligure di Storia Patria in Genoa, Italy*. On the obverse is the seated figure of Cafaro, a statesman of Genoa, died 1163, author of a history of Genoa; on the reverse, a dedication and the dates 1858–1908. Diameter, 1½ inches. (Cat. No. 255160, U.S.N.M.)

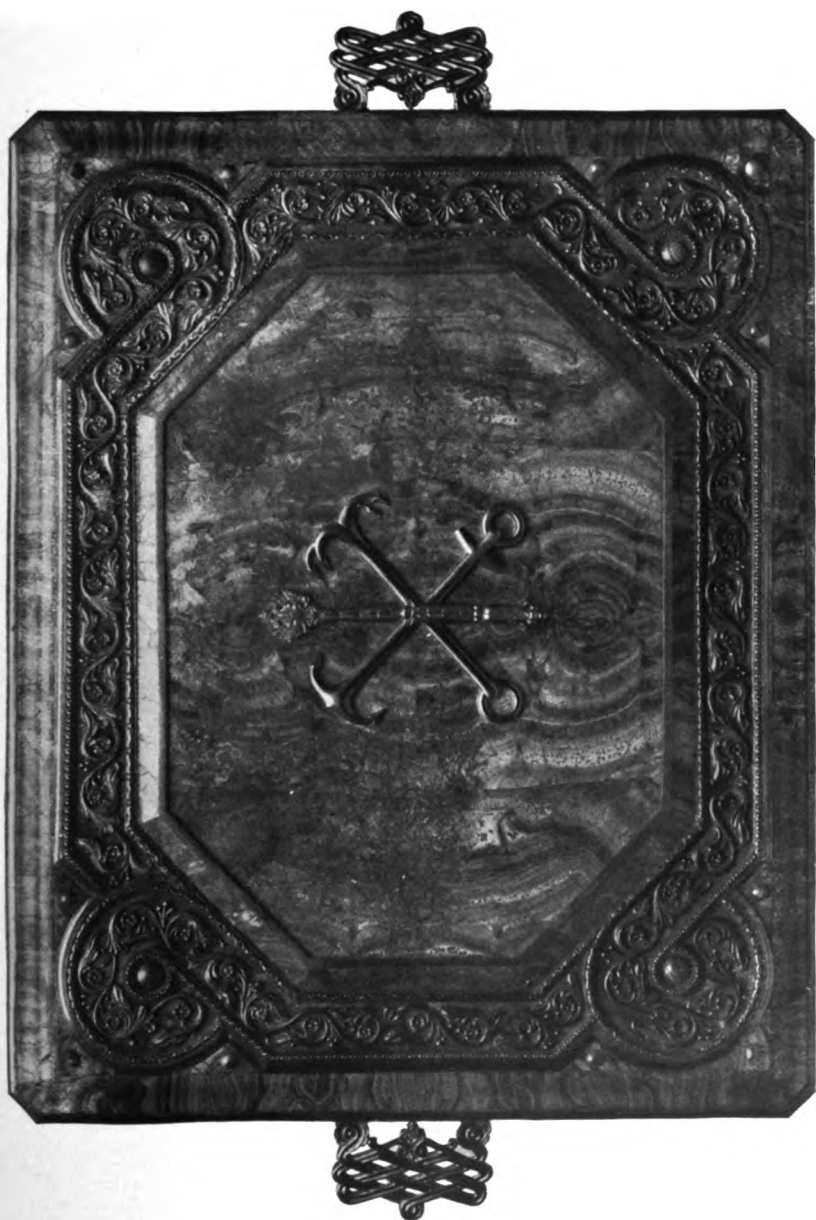
67. *The case of the United States to be laid before the Tribunal of Arbitration, to be convened at Geneva under the provisions of the treaty between the United States of America and Her Majesty the Queen of Great Britain, concluded at Washington May 8, 1871*. Washington, 1872. Pages 204, octavo, with one map. Bound in cloth. Height, 9 inches; width, 6 inches. (Cat. No. 255653, U.S.N.M.)

68. *Report of the joint select committee to inquire into the condition of affairs in the late insurrectionary States*. Made to the two Houses of Congress, February 10, 1872. Washington, 1872. Pages 632, octavo. Bound in cloth. Height, 9½ inches; width, 6 inches. (Cat. No. 255688, U.S.N.M.)



DIPLOMA OF HONORARY CITIZENSHIP OF ST. PETERSBURG.

FOR DESCRIPTION SEE PAGE 4.



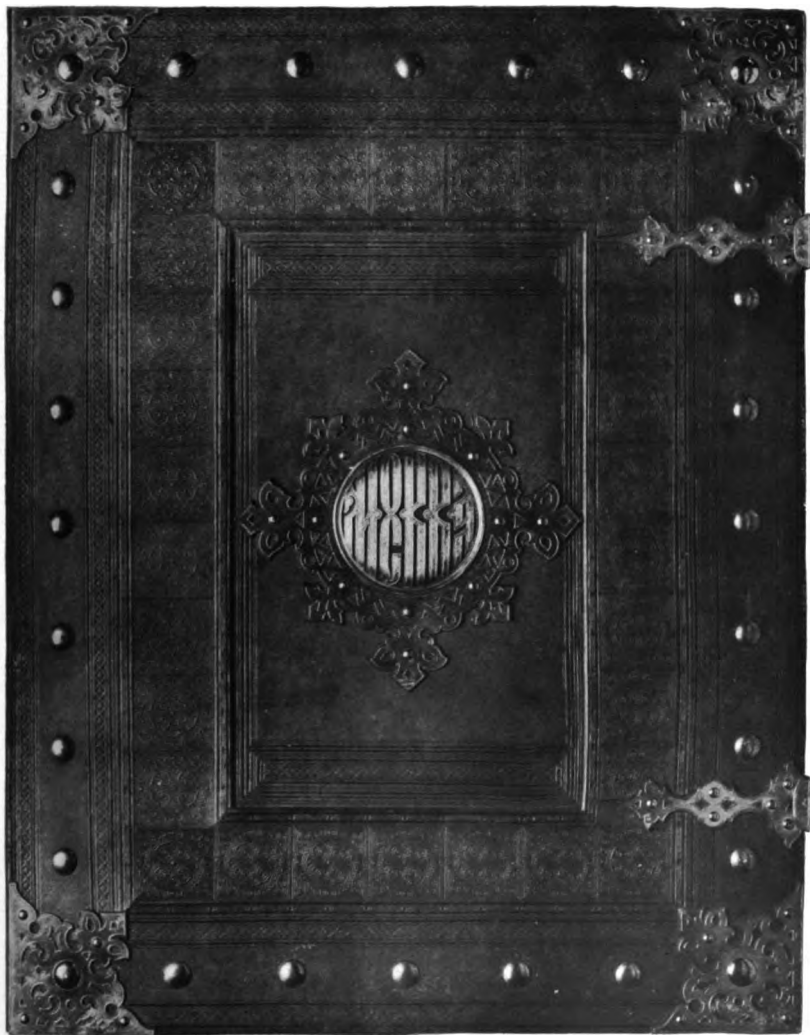
MALACHITE CASKET FOR DIPLOMA OF HONORARY CITIZENSHIP OF ST. PETERSBURG.

FOR DESCRIPTION SEE PAGE 5.



DIPLOMA OF HONORARY CITIZENSHIP OF MOSCOW.

FOR DESCRIPTION SEE PAGE 5.



PORTFOLIO FOR DIPLOMA OF HONORARY CITIZENSHIP OF MOSCOW.

FOR DESCRIPTION SEE PAGE 6.



MEMORIAL FROM CHEREPOVETZ.

FOR DESCRIPTION SEE PAGE 6.



PORTFOLIO WITH THE ARMS OF KRONSTADT.

FOR DESCRIPTION SEE PAGE 7.



COMMEMORATION MEDALS: OBVERSE.

1. FOR DESCRIPTION SEE PAGE 8.
2. FOR DESCRIPTION SEE PAGE 8.
3. FOR DESCRIPTION SEE PAGE 8.
4. FOR DESCRIPTION SEE PAGE 9.



COMMEMORATION MEDALS: REVERSE.

1. FOR DESCRIPTION SEE PAGE 8.
2. FOR DESCRIPTION SEE PAGE 8.
3. FOR DESCRIPTION SEE PAGE 8.
4. FOR DESCRIPTION SEE PAGE 9.

ON SAND-BARITES FROM KHARGA, EGYPT.

By JOSEPH E. POGUE,

Assistant Curator, Division of Mineralogy, U. S. National Museum.

Introduction.—Calcite, gypsum, and barite are distinguished, above all other minerals, by the large quantities of sand which they can inclose upon crystallization, without being materially hindered in the development of crystal outline. As examples of the first, there come to mind the well-known sand-calcites of Fontainebleau, France, containing 50 to 60 per cent sand, which have been described by Lassone^a and Haüy;^b and the siliceous calcites from the Bad Lands of South Dakota, with 60 to 63 per cent of rounded quartz grains, accounts of which have been given by Penfield and Ford^c and by Barbour.^d Examples of the second are not so familiar, but gypsum including fine sand is found in Sussex, New Brunswick;^e Carcote, Bolivia;^f and some other localities. Sand-barites are also uncommon. It is the purpose of this paper to recount the localities where these, as well as baritic sandstones, occur; and to describe, from a new locality,^g an unusually full suite of crystals and groups acquired in November, 1909, by the U. S. National Museum (Cat. No. 86580).

Historical.—The first mention of arenaceous barites appears to be in 1853, when Reuss^h called attention to thin tabular crystals inclosing much sand, which had been discovered at Tetschen, near Trebnitz, Bohemia.

^a Mem. Acad. Roy. Paris, 1775, p. 65.

^b *Traite de Mineralogie*, vol. 1, 1822, p. 424.

^c Amer. Journ. Sci., vol. 9, 1900, pp. 352-354.

^d Bull. Geol. Soc. Amer., vol. 12, 1901, pp. 165-178. Also Barbour and Fisher, Amer. Journ. Sci., vol. 14, 1902, pp. 451-454.

^e Amer. Journ. Sci., vol. 35, 1863, p. 213.

^f Verh. Verein Santiago, Chile, vol. 2, 1892, p. 238.

^g M. J. Couyat (*La célestite et la barytite d'Egypte*. Bull. Soc. Min. France, vol. 31, 1908, p. 298) devotes a half page to a brief account of clear crystals of barite from Kharga, showing the following forms (001), (110), (011), (010), (130), (210), (102), (111). These, however, do not contain sand.

^h A. E. Reuss, [Note], *Lotos, Zeitschr. für Naturw.*, Prague, vol. 3, 1853, p. 72.

The following year Bischof^a stated that sandstone cemented by barium sulphate occurs at Münzenberg, in the Wetterau district of Germany; and that in the district of Kreuznach and near Leipzig, Germany, and in the vicinity of Bologna, Italy, are found globular concretions composed of sand, barite, and some clay.

In 1868 Laspeyres,^b in discussing the wells near Dürkheim, in Bavaria, Germany, said that baritic sandstone had been encountered in a bore hole at depths of 330 and 820 feet.

In 1883 Zittel^c reported that, during an exploration of the Lybian Desert of northeastern Africa, he had gathered rounded and slightly flattened sand-barite concretions from the isolated mountain of Gella Siui, between Bauite and Häss.

In 1889 Clowes^d announced that some of the Triassic sandstones near Nottingham, England, are cemented with 33 to 50 per cent barium sulphate. He directed attention in particular to a sandstone pillar, some 30 feet in height and 70 feet in circumference, which is crowned by a flattened mushroom-like cap of baritic sandstone.

In 1897 Polak^e described crystals of barite from a railroad cut near Tetschen-Bodenbach, Bohemia, and said that some of these contain included quartz grains.

The year following, Moore^f added another locality, near Bidston Hill, in the Triassic of England. There the barite is present in quantities up to 34 per cent as a cement in globular sand concretions, the size of walnuts, which weather out from the sandstone.

In 1899 Clowes^g referred to his previous communication, and stated further that barium sulphate is not rare among the Triassic sandstones of England. The same year, Wedd^h mentioned the presence of baritic sandstone in North Staffordshire.

^a G. Bischof, *Chemical and Physical Geology*, vol. 1, 1854, p. 433.

^b H. Laspeyres, Kreuznach und Dürkheim a. d. Hardt. *Zeitschr. Deutsch. Geol. Ges.*, vol. 20, 1868, p. 174.

^c K. A. Zittel, *Beiträge zur geologie der Libyschen Wüste. Palaeontographica*, vol. 30, 1883, p. 121.

^d F. Clowes, Barium sulphate as a cement in sandstone. *Proc. Roy. Soc.*, vol. 46, 1889, pp. 363-368.

^e J. M. Polak, Ueber Baryt krystalle von der Bohemia bei Tetschen-Bodenbach. *Sitzungsb. Deutsch. Nat. Med. Ver. Lotos. Prague*, vol. 17, 1897, pp. 78-80.

^f C. C. Moore, The Chemical examination of sandstone from Prenton Hill and Bidston Hill. *Proc. Liverpool Geol. Soc.*, vol. 8, 1898, pp. 241-267. Especially pp. 266-267.

^g F. Clowes, Deposition of barium sulphate as a cementing material in sandstone. *Proc. Roy. Soc.*, vol. 64, 1899, pp. 374-377.

^h C. B. Wedd, Note on barium sulphate in the Bunter sandstone of North Staffordshire. *Geol. Mag.*, vol. 6, 1899, p. 508.

In 1900 Delkeskamp^a gave an extensive paper on sand-barites in the Wetterau and Rheinhessen districts of Germany, in which he described rosettes and concretionary forms from the Tertiary sandstones. The concretions are sometimes hollow and contain barite crystals.

In 1901, Beadnell^b found numerous specimens of "crystallized barytes-sandstone" in the Dakhla Oasis of Egypt. These are briefly described as tabular crystals, often intergrown into masses of various sizes, and having a specific gravity of 3.25 and silica content of 55 per cent. In the same year Mackie^c cited the occurrence of arenaceous barite in the form of nodules disseminated through the Triassic sandstone along the coast of Elginshire, England.

In 1902, Delkeskamp^d included in a second paper an account of the sand-barites from Rockenberg and Vilbel, Wetterau; and Kreuznach, Rheinhessen. In Rockenberg occur well-developed rosettes or "roses," often uniting in extensive groups; and larger, spherical concretions, frequently slightly intergrown.^e The Vilbel forms are prominently tabular and simpler. The Kreuznach individuals are mostly spherical and possess an inner radial structure; they are frequently intergrown and show strange shapes, resembling pears, turnips, etc. From 20 to 30 per cent sand is present in the various occurrences.

In 1906 Nichols^f described sand-barites from near Muskogee, Oklahoma. These are rosettes made of intergrown plates and are somewhat rounded by wind action. The content of angular quartz fragments is 37 per cent. The U. S. National Museum possesses specimens from near Bavaria, Saline County, Kansas (Cat. No. 85275), which are very similar to those from Oklahoma.

Occurrence.—The specimens to be herein described were collected by Dr. A. Hrdlička, of the U. S. National Museum, while on an anthropological expedition to Egypt in 1909. They occur in the Lybian Desert, and more particularly in the central part of the Kharga

^a R. Delkeskamp, *Schwerspatvorhommnisse in der Wetterau und Rheinhessen und ihre Entstehung*. Notizbl. Ver. Erdkunde, vol. 21, 1900, pp. 47–83.

^b H. J. L. Beadnell, *Dakhla Oasis: Its topography and geology*. Egypt. Geol. Surv. Rept., 1901.

^c W. Mackie, *The occurrence of barium sulphate and calcium fluoride as cementing substances in the Elgin Trias*. Rep. Brit. Ass. Adv. Sci., 1901, p. 649.

^d R. Delkeskamp, *Ueber die Krystallisationsfähigkeit von Kalkspat, Schwerspat, und Gyps bei ungewöhnlich grosser Menge eingeschlossenen Quarzsandes*. Zeitschr. Naturw., Halle, vol. 75, 1902, pp. 185–208.

^e The National Museum possesses specimens from Rockenberg, Cat. No. 80612.

^f H. W. Nichols, *Sand-barite crystals from Oklahoma*. [In *New forms of concretions*.] Publ. Field Col. Mus., Geol. Ser., publ. 111, vol. 3, 1900, pp. 31–35.

Oasis near the village of Kharga, which is about 300 miles south of Cairo and nearly 100 miles west of the Nile. There are several ranges of small mountains within the oasis, and in the foothills of one of these, on a conical hill about 20 feet high, the specimens were found lying loose in the sand. In a few places is exposed the solid rock, which is doubtless the Nubian sandstone of Upper Cretaceous age, that plays so important a part in the scenery of northeastern Africa.^a

To convey a better idea of the region, the following description is excerpted from an article by a former member of the Egyptian Geological Survey:

The Lybian Desert is the easternmost and most inhospitable portion of the Sahara or Great Desert of Africa. The region is practically rainless and the greater portion is quite devoid of vegetation, and is uninhabited even by nomad tribes. The extreme barrenness of the desert as a whole, however, is in great measure counterbalanced by a number of isolated, highly fertile oases, in which there is a permanent resident population. The chief groups of oases are the Siwan on the north, that of Kufra on the west, and the Egyptian, including the four large oases of Baharia, Farafra, Dakhla, and Kharga, on the east. The Egyptian oases occupy extensive depressions cut down nearly to sea level through the generally horizontal Cretaceous and Tertiary rocks forming the Lybian desert plateau. These depressions owe their origin in great measure to the differential effect of subaerial denudation acting on rock masses of varying hardness and composition.^b

Description.—The suite contains some eighty-five representative specimens, ranging from simple rounded tablets to very involved intergrowths, and varying in size from three-fourths inch (19 mm.) to 2½ inches (70 mm.) in diameter. They are composed of about equal percentages of quartz sand and the mineral barite or heavy spar, and in color and luster resemble maple sugar. Their surface has a fine-granular appearance because the rounded quartz grains protrude very slightly from the baritic cement. The only crystal face present is the basal plane *c* (001), which, however, is universally developed and controls the habit of every unit and compound.

The simplest form, which may be considered the fundamental one, since it enters into the makeup of every aggregate, is occasionally found in single development, as shown in figs. 1 and 4, plate 9. This is a flat crystal bounded above and below by basal planes and circular in outline with scalloped border. To one looking down upon an edge it has the appearance of being laminated or twinned parallel to the base, and possibly represents a serrate-edged group produced by

^a A. Geike, *Textbook of Geology*, vol. 2, p. 1207.

^b H. J. L. Beadnell, *Flowing wells and subsurface water in Kharga Oasis*. *Geol. Mag.*, vol. 5, 1908, pp. 49-57; 102-108. For a very entertaining account of this oasis, which combines scientific accuracy with liveliness of portrayal, the reader is referred to a recently published book by the same author, entitled *An Egyptian Oasis*; an account of the Oasis of Kharga in the Lybian Desert. London, 1909.

the parallel growth of small plates. Its rounded contour is in all probability due to a concretionary tendency; that is to say, its imperfect crystal form is supposed to be the resultant of two molecular forces, the one striving for the formation of crystal outline, the other intent upon the development of concretionary structure, and each partly successful. In other words, the completion of the concretion was prevented by the development of two crystal planes—the very two planes, indeed, which in barite are potentially the most powerful, as evidenced by their universal occurrence and the perfect cleavage parallel to them. The tablet can not owe its rounded outline to the carving effect of wind-blown sand, for similar shapes are found in protected positions within complex groups, nor is there ever any sign of differential abrasion.

A second type, more complicated, is shown in figs. 2, 3, 6, and 7, where two or more plates similar to the one described above interpenetrate. There is universally a central tablet, to which the others are variously inclined, and the several components apparently possess a *b*-axis in common. Usually two oppositely-inclined plates (fig. 2) make angles of 30° with a central one, though angles of 12° and 45° are not uncommon, and those of 65° , 70° , and even 90° (fig. 7) are occasionally met with. Many of these inclinations may be included in a single group; or by various permutations of two similarly inclined plates with one or more differently inclined even more complex assemblages may be formed.

Other still more involved growths have, in addition to plates crossing with *b*-axes in common, other plates variously inclined to these. The common disposition thus effected is shown in figs. 8 and 10, where three plates are inclined 30° to the base of a central plate, with angles of about 120° to 150° between their own planes. From above a three-sided, hopper-shaped appearance is presented. Evidently in such occurrences one or more of the plates fail to have even a single axis in common with the other plates possessing a mutual *b*-axis. Occasionally, too, a four-sided hopper is developed, as shown in figs. 9 and 11, where two of the secondarily inclined plates have opposite inclinations in respect to each other. Not infrequently the two patterns just described will be seen on the same specimen, the one on one side and the other on the other. Indeed, throughout the entire suite the two sides of the central tablet are almost invariably differently modified. Again, there are spherical skeleton forms, composed of many thin plates of nearly like diameter, resembling the rosettes from Rockenberg described by Delkeskamp.^b

^a The angles are only approximate, as exact measurements could not be made.

^b *Zeitschr. Naturw. Halle*, vol. 75, 1902.

Upon the types described are frequently subsidiary growths, giving rise to strange and ungainly forms. An example is shown in fig. 13, where a slender pile of small tablets has grown out at an angle from the main mass. There is evidently little regularity in the manner of attachment of these secondary members.

Symmetrical rosettes of the nature shown in fig. 5 are rare. Their regularity of structure is interesting. They are built up from a central plate by the piling around of other and smaller plates, with ever increasing inclinations to the central one, until the uppermost is nearly on edge. During their growth the *c*-axis of the consecutive individuals departs more and more from a vertical position, and the *b*-axis, so to speak, makes many complete revolutions in its several positions.

Fig. 12 represents the rare occurrence of two aggregates slightly intergrown. There are only two other cases of attachment in the entire suite.

An unusual radiate assemblage, composed of numerous elongated plates diverging from a center, is shown in fig. 14. This well illustrates the existence of two molecular forces of a somewhat different order, the one developing thin tables and the other uniting these in a common point.

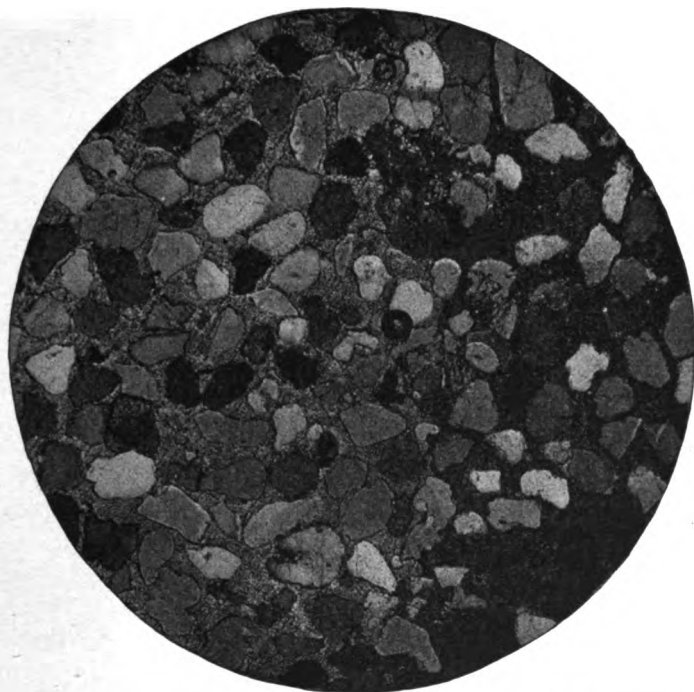
Finally, fig. 15 pictures a development represented only twice in the present collection and resembling some of the barites from Vilbel, Germany, as described by Delkeskamp.^a This example consists of a thin, irregular sheet, with a surface of numerous globular masses, 2 to 5 mm. in diameter. It is entirely concretionary in nature (as the microscope also shows) and would seem to represent a case in which the crystallizing force was insufficient to inhibit a complete concretionary development.

Microscopic.—Several thin slices of the specimens were studied under the microscope. Three cases were considered:

1. Sections cut parallel to the basal plane, *c*. These show numerous rounded and some angular quartz grains, set in a cement of barite. The grains are usually from 0.25 to 0.5 mm. in diameter, and are rarely in contact with one another. The barite has the same orientation throughout, extinguishing simultaneously. It possesses two good cleavages parallel to the *m* (111) faces and crossing at angles of 78° and 102°; the more perfect basal cleavage is in the plane of the slide, and consequently not visible. A small amount of yellow, opaque, pulverulent limonite is present, either staining slightly the cleavage cracks of the barite and the edges of the quartz grains or forming small aggregates. No other constituents could be determined. The material is remarkably clean and pure.

^a Zeitschr. Naturw, Halle, vol. 75, 1902.

2. Slide prepared at right angles to a penetration twin, a microphotograph of which is reproduced in the accompanying figure. The quartz presents the same features as in case 1. The barite, however, shows the perfect *c* or basal cleavage, dividing the mineral into long strips, with the less prominent *m* cleavages at right angles. There are two individuals, each of which extinguishes in polarized light as a unit, and has the same orientation of cleavage throughout. The extinction is parallel to the *c* cleavage, and the angle measured between the twinned parts is 30° .



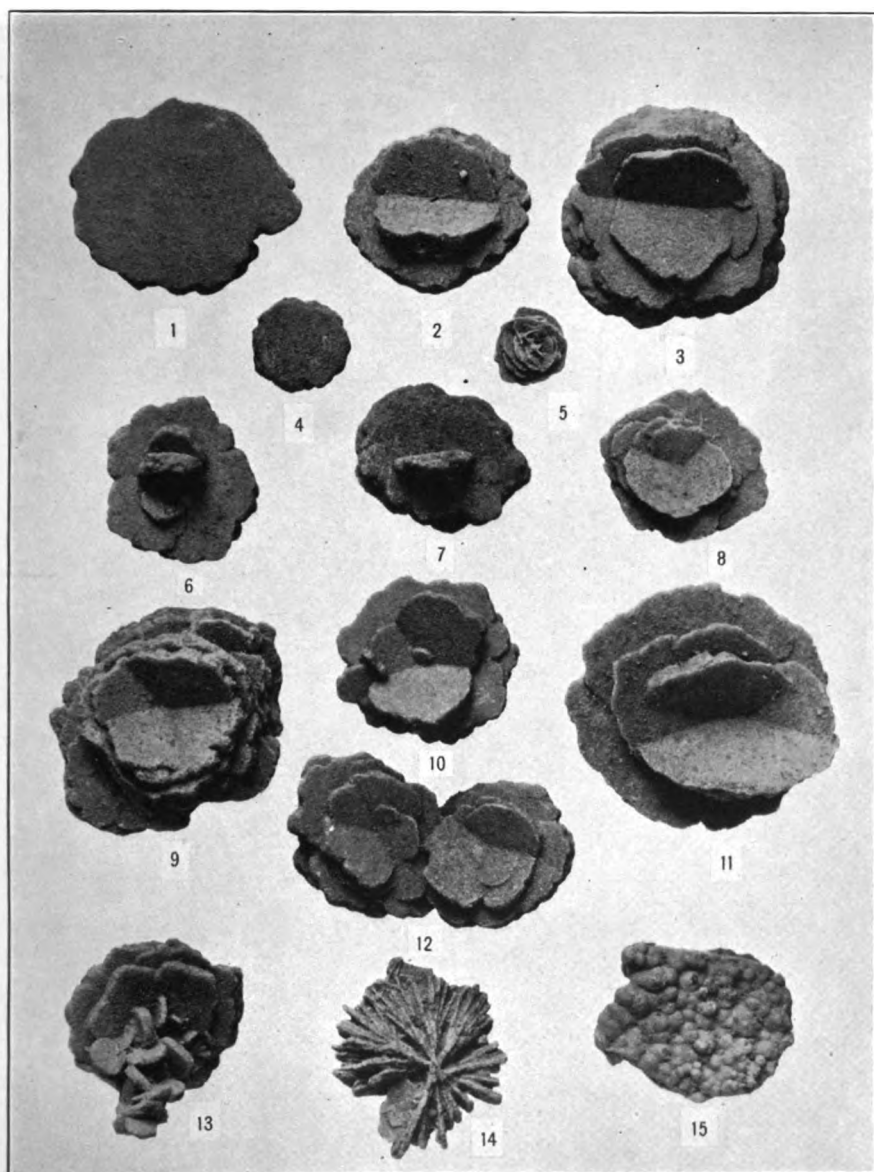
PHOTOMICROGRAPH OF A THIN SLICE OF SAND-BARITE, CUT AT RIGHT ANGLES TO A PENETRATION TWIN OF TWO TABULAR INDIVIDUALS CROSSING AT AN ANGLE OF 30° . POLARIZED LIGHT; MAGNIFICATION ABOUT 25 DIAMETERS. ROUNDED AND SLIGHTLY ANGULAR QUARTZ GRAINS ARE ABUNDANTLY INTERSPERSED IN A GROUND OF REGULARLY ORIENTED BARITE. THE INDIVIDUAL TO THE RIGHT IS NEARLY EXTINGUISHED, WHILE THE ONE TO THE LEFT IS BRIGHTLY ILLUMINATED. THE BASAL CLEAVAGE MAY BE SEEN IN EACH.

3. Cross-section of the concretionary specimen shown in fig. 15. In this the barite is without regular orientation of cleavage, and its extinction is undulatory. At no time during the revolution of the stage does the baritic matrix become dark. This example differs markedly, therefore, from the other instances in that the barite possesses no continuity of arrangement.

Chemical.—The percentage of sand in different specimens was found to vary. The limits are 44 and 53 per cent sand, with values between

these figures. An average of five determinations for specific gravity gives 3.26. The silica content, calculated from this value, is 53.5 per cent.

Genesis.—The specimens were probably formed during the consolidation of the Nubian Sandstone in Upper Cretaceous or later time by the deposition from solution of barium sulphate in the interstices of a loose sand. The linear force of crystallization pushed the sand grains slightly apart, and the less well-understood power, which makes for an orderly molecular arrangement, developed an outer form in keeping with an inner structure.



REPRESENTATIVE SPECIMENS OF SAND-BARITE FROM KHARGA, EGYPT. ABOUT $\frac{1}{2}$ NAT. SIZE.

FOR DETAILED DESCRIPTION SEE PAGES 20 TO 22.

THE BIRDS COLLECTED AND OBSERVED DURING THE
CRUISE OF THE UNITED STATES FISHERIES STEAMER
"ALBATROSS" IN THE NORTH PACIFIC OCEAN, AND IN
THE BERING, OKHOTSK, JAPAN, AND EASTERN SEAS,
FROM APRIL TO DECEMBER, 1906.

By AUSTIN HOBART CLARK,

Assistant Curator, Division of Marine Invertebrates, U. S. National Museum.

The 1906 cruise of the United States Fisheries steamer *Albatross* had for its especial object the investigation of the fish and fisheries of the Japanese seas, where the ship spent most of the time. The journey out was made by way of the Aleutian Islands, at several of which we stopped, Petropaulski, Kamchatka, and the Kuril islands. We returned by way of Honolulu. As the purpose of the expedition was the investigation of fish and marine invertebrates, and the ship was usually occupied in work offshore, my opportunities for collecting birds were rather limited, especially as my time was largely taken up by my duties in connection with the marine work, as the representative of the Bureau of Fisheries. I brought back about 180 skins, chiefly from the Aleutian and Kuril islands and from Kamchatka. In addition to these many dead birds were examined and identified, but not preserved, mainly on account of their bulk, which would have necessitated devoting more time to them than I could spare. I kept very full notes at all times during the trip, and these, together with the specimens, form the basis of the present paper.

During the trip of the *Albatross* I was afforded every possible facility for ornithological work by the commanding officer, the late Commander Leroy M. Garrett, U. S. Navy, and after his untimely loss, in a prolonged spell of exceptionally heavy weather between Yokohama and Honolulu, by his successor, Lieut. Arthur J. Hepburn, U. S. Navy.

We left Sausalito, near San Francisco, on May 3, 1906, at 4.40 p. m., and sailed up the coast of California and Oregon to Puget Sound, arriving at Tacoma at 8 p. m. on the evening of the 9th. We left early the next morning for Dockton, Washington, where we went into dry dock. I spent that afternoon, the next day, and the following morning ashore hunting birds. We left at 4 p. m. on the 11th, going through the Colvos Passage to the Puget Sound Navy Yard at

Bremerton, where we arrived at about 7 p. m. Lieutenant Hepburn and I went by a local boat to Seattle the next morning on business, the *Albatross* meeting us there in the afternoon.

We left Seattle at 10.35 a. m. on the 13th, arriving at Union Bay, Vancouver Island, at 7 a. m. the next morning. I had two and a half days ashore here. We left at 7 a. m. on the 17th, and passed up the inland passage between Vancouver Island and the mainland, anchoring over night in Forward Bay, Johnstone Strait. At 6 a. m. on the 18th we got underway, stood westward through Johnstone Strait, and took the great circle course for Unalaska, where we secured to the wharf at Dutch Harbor at 4.19 p. m. on the 24th. We left Dutch Harbor early in the morning of the 28th, bound for Atka, where we arrived at 6.45 a. m. on the 30th, anchoring in Nazan Bay. On the way from Unalaska to Atka we passed close to that most interesting trio (previously pair) of volcanic islands, the Bogoslovs.

Leaving Atka at 6.05 a. m. on the 31st, we cruised about in Bering Sea in a general northerly direction, passing over Bower's Bank, our farthest north being lat. $54^{\circ} 32' 30''$ N., which we reached in long. $179^{\circ} 16' 00''$ E. on June 3 (omitting June 2). From Bower's Bank we went southward past Semisopochnoi and Amchitka, then in a westerly direction to Agattu, where we anchored, in McDonald Bay, at 7.51 p. m. on June 7. I spent the next morning ashore, but I had not got very far inland when I heard the whistle of the steamer and hastened back to the beach to find that in the meantime a wind had risen directly on shore which threatened to make the anchorage dangerous for the ship; even as it was we had a very hard pull back. I was forced to abandon a number of specimens here, all large birds, which I had shot and "cached" at various places, as the hurry call from the steamer compelled me to take the shortest route to the beach, and returning the way I had come would have entailed considerable delay. We left Agattu at 6.50 p. m. on the 8th for Attu, passing the Semichi Islands, and anchoring in Chichagof Harbor, Attu, at 4.12 p. m. on the 9th. I spent the evening ashore here, all the next day, and the morning of the 11th. We left at 3.59 p. m. on that date, and did some deep-sea work between Attu and Copper Island, arriving at Preobrajnia Bay, Copper Island, at 9.30 a. m. on June 13. Here I spent the afternoon and evening ashore. We left at 7 a. m. on the 14th, and at 9.10 a. m. on the 15th anchored in Nikolskoi Bay, Bering Island. I went ashore as soon as possible, returning about 8.30 p. m. We got underway at 5.05 a. m. on the 16th, and at 4.37 p. m. on the 17th arrived in Petropaulski, Kamchatka. We left Petropaulski at 8.20 a. m. on the 20th, sailing south along the Kamchatkan coast, rounding Cape Lopatka and sailing up the west coast to the mouth of the Aangan River, in about lat. $51^{\circ} 30' 00''$ N. From this point we went south along the Kurils to Simushir, where at 8.27 a. m. on June 23 we came to anchor in Milne Bay.

At 8.05 the next morning we were again underway, and proceeded south, arriving in Hakodate, Japan, at 11.53 on June 27. On July 5 we made a short trip to Mororan for coal, returning on the 7th; on the 16th we left Hakodate for the Japan Sea, where we stayed nearly a month, calling in at an anchorage 2 miles north of Kodomari (July 16), Ebisu Byochi, Sado Island (July 18), Nanao (July 20), Tsuruga (July 23), Saigo Minato Harbor, Oki Islands (July 25), Matsushima (July 28), and Nagasaki (August 3). From Nagasaki we went southward among the Linschoten Islands, as far as lat. $29^{\circ} 51' 00''$ N., long. $131^{\circ} 02' 00''$ E., thence north to Kagoshima, where we arrived on August 17. From Kagoshima we went eastward along the southern Japanese coast, calling in at a harbor near Wado Misaki light (August 24), and going through the Inland Sea to Kobé, where we arrived on the 25th. We left Kobé on the 27th for Yokohama, calling at Yura-no-Uchi (August 27) and Oshima Ko (August 28, 29, and 30), and arriving on September 2. We left Yokohama on September 14, called in again at Hakodate on the 17th, at Iwanai, in Iwanai Byochi, on the 19th, at Otaru on the 20th, and on the 24th reached Korsakoff, Sakhalin, where I had a morning ashore. Before calling at Korsakoff we went up the west coast of Sakhalin (Gulf of Tartary) as far as lat. $47^{\circ} 39' 00''$ N., which point we reached on September 23. From Korsakoff we went up the east coast of Sakhalin as far as Cape Patience ("Terpenia") (September 27), then across the Okhotsk Sea to the southernmost Kurils, and down the coast of Yezo to Hakodate, which we reached on October 4. From Hakodate we went south along the east coast of Hondo, anchoring off the village of Kugunari, To Shima peninsula, on the night of the 9th, and reaching Shimidzu in Suruga Gulf on the 12th. We worked in this vicinity until the 18th, returning to Shimidzu every night; on that date we left, cruising about to the southward until the 21st, when we called at Monagawa village in Fuki Ura, Sagami Kai. We worked about here, returning every night until the 25th, when we left for Yokohama, anchoring that night in Kaneda Bay, and reaching the Yokohama light-ship the next evening. On November 10 we left Yokohama for Honolulu, arriving on the 24th after a fifteen days' trip, and proceeding on December 2 to San Francisco, where we dropped anchor on the evening of the 10th.

A preliminary paper dealing with the new forms which I detected among the material studied in connection with this report was published in these Proceedings, vol. 32, pp. 467-475. In that paper I took occasion to call attention to the peculiarities of that curious finch, the *Emberiza variabilis* of Temminck, by erecting a new genus, *Tisa*, for its reception, a course long ago suggested by Doctor Stejneger.^a

^a Bull. 29, U. S. Nat. Mus., 1885, p. 247.

A second paper dealing with the habits of the more common Kamchatkan birds was published in *The Auk*, vol. 24, 1907, pp. 278-280.

I have adhered to the classification given in the American Ornithologists' Union check list, in spite of the fact that I consider it decidedly out of date, for the reason that, as this paper will be of most interest to American ornithologists, an arrangement familiar to them will have, in so far as they are concerned, certain advantages and will be much more convenient to use. Had this paper included only extra American species, I should have adopted the classification of Prof. Hans Gadow, as emended by subsequent authors, as I did in my papers on West Indian birds.

Before joining the *Albatross* I made a thorough study of the sea birds of the north Pacific, especially in regard to the most significant and striking differential characters, so that I might be able to identify them with certainty. Observations were made constantly with a good pair of marine binoculars while on shipboard. Previous experience with the land birds of both the nearctic and palæarctic regions in the field made the work on shore comparatively easy, so far as determination of species was concerned.

The vernacular names of American birds are, of course, those of the check list published by the American Ornithologists' Union. Dr. Leonhard Stejneger's various papers on Japanese birds, Seebohm's *Birds of the Japanese Empire*, and other standard works have been consulted for appropriate names for purely Asiatic species, while to the English names of Kamchatkan and Kurilian birds I have added the local Russian and native names, taken from Doctor Stejneger's works on the birds of Kamchatka and the Commander Islands and on the birds of the Kuril Islands.

Order PYGODES.

Suborder PODICIPEDES.

Family PODICIPIDÆ.

ÆCHMOPHORUS OCCIDENTALIS (Lawrence).

WESTERN GREBE.

This grebe was common in San Francisco Bay on the day we left, and we also found it common in the more open parts of Puget Sound.

COLYMBUS AURITUS Linnaeus.

HORNED GREBE.

Rather common in Puget Sound, especially before reaching Port Townsend. In going up the Sound to Tacoma sea birds were very abundant until we were off Port Townsend, when their numbers rapidly diminished, and from then on, except for gulls and certain ducks, we saw comparatively few.

Suborder CEPPHI.

Family GAVIIDÆ.

GAVIA PACIFICA (Lawrence).

PACIFIC LOON.

Common off the mouth of the Columbia River, and again in Puget Sound as far as Port Townsend. Several were seen at Union Bay, Vancouver Island, and in the passage between Vancouver Island and the mainland, especially about the head of Georgia Gulf, where they were common. A single bird of this species was seen on one of the lakes on Agattu, and two near the beach at Simushir, in the Kurils.

GAVIA ARCTICA (Linnaeus).

BLACK-THROATED LOON.

A single example of this species was seen flying over the sand bar separating the large pond from the sea behind the town of Petropaulski, Kamchatka.

GAVIA STELLATA (Pontoppidan).

RED-THROATED LOON.

Seen at sea off the mouth of the Columbia River, and in Puget Sound, but not met with past Port Townsend. A pair was observed near the shore at Agattu, a single bird at Atka, and a pair on a small pond on Bering Island.

Family ALCIDÆ.

Subfamily FRATERCULINÆ.

LUNDA CIRRHATA Pallas.

TUFTED PUFFIN. TOPOROK. ETUBIRGA. STUPIRK.

We first met with the Tufted Puffin the day after leaving San Francisco, when two were observed at sea; after that they became rather more common, occasional individuals, pairs, or small companies of three or four being seen all the way up to Puget Sound, except on the morning of May 8, at which time we were off the mouth of the Columbia River. In the Sound they were very common, usually in pairs, until the vicinity of Port Townsend was reached, after which none were seen until we passed Port Townsend again going north. In the passage between Vancouver Island and the mainland none were met with; but soon after we reached the open sea they reappeared, though in small numbers, and were observed continuously until we reached the Aleutian chain, becoming gradually more common as we approached Unalaska, being especially abundant in Unalga Pass, between Akutan and Unalaska. All about the shores of Unalaska and the neighboring islands, and everywhere we went in Bering Sea, they were common. On May 28 we visited the Bogos-

lov Islands, a group of three small volcanic islands, one of which was first reported in 1796, another in 1884, while the third we were fortunate enough to be the first to observe. This newest island was still steaming violently from fissures over its entire surface, but the other two islands were apparently cold. About Castle Island (which was the first to have been reported) could be seen with a glass myriads of sea birds, flying all about the shores, over the sea, and to a considerable height over the land. I have never anywhere seen any approach to the enormous number of birds about this island. On the sea in this vicinity large numbers of this species were seen, but even more numerous were the murre (*Uria*); so, as no other species of the family were observed, I judged that these were the birds which chiefly made up the vast numbers seen over the land. I may also mention that about the shores of Castle Island we saw many sea lions (*Eumetopias stelleri*), this being the only place where we found them in abundance.

About the rocky shores of Atka we saw the Tufted Puffin frequently, though in the parts we visited it could not be called abundant. At Agattu, however, it was the most numerous sea bird, occurring by hundreds along the cliffs and bluffs in the vicinity of Macdonald Bay where we lay at anchor. Most of them were flying aimlessly back and forth along the coast, now and then taking short excursions out over the sea only to return a few minutes later, while many were sitting on the water. We found dozens of their burrows on shore, mainly along the gravelly grass-covered bluffs facing the sea, but also along the sides of a ravine which makes inland half a mile or more from the coast from the head of Macdonald Bay. Most of the burrows (which are somewhat large for the size of the bird and resemble those made by foxes) were rather high, the lowest being some 15 or 20 feet above the beach, and in the ravine they chose the steepest places, near the top. No eggs were found, although many of the birds were seen to come out of the burrows, and one was captured by some sailors from the ship before it had time to get away. Perhaps this was largely due to a rather general reluctance on the part of the men to investigate deep holes tenanted by birds with such formidable beaks.

After leaving Agattu we found these birds common off Semichi, about Attu and Copper Island, and everywhere at sea. On Torporkov ("Puffin") Island, at the entrance to the harbor of Nikolskoi, Bering Island, we found them by thousands, and they were especially abundant on the water in the outer harbor.

On the way from Bering Island to Petropaulski they were not at all numerous; they were rather common about Avacha Bay, but the numbers here could not be compared with those about the western Aleutian or Commander islands. We saw them frequently

down the Kamchatkan coast to Cape Lopatka, and up into the Okhotsk Sea as far as we went; they were rather common down the Kurils to Simushir, then occasional to the northern end of Yezo.

FRATERCULA CORNICULATA (Naumann).

HORNED PUFFIN. IPATKA. IPATOK. MATSCHIR.

We first met with the Horned Puffin in Unalga Pass, near Unalaska, where it was rather common. It was found about the shores of Unalaska and Atka, and a few companies of six or eight were seen at Agattu, together with some single birds. A few individuals were found at Copper Island, and one or two at Bering Island. They were nowhere nearly as abundant as the preceding.

Subfamily ÆTHIINÆ.

CERORHINCA MONOCERATA (Pallas).

RHINOCEROS AUKLET.

This species was observed in limited numbers at Atka and at Agattu, and in the northern Kurils I occasionally noticed small companies on the water as far south as Simushir.

PTYCHORAMPHUS ALEUTICUS (Pallas).

CASSIN'S AUKLET.

Cassin's Auklets were common at sea in flocks from about southern Oregon to Puget Sound, except in the vicinity of the Columbia River. In Puget Sound they were abundant until we passed Port Townsend. After leaving Union Bay we saw them frequently until we reached the upper part of Georgia Gulf, where they were abundant, the numbers again falling off until we reached the open sea. Here we saw hundreds of them in flocks of from 10 to 50, well offshore. They were also noticed about Unalaska, Agattu, and Atka, and a few were seen just outside the harbor at Attu.

PHALERIS PSITTACULUS (Pallas).

PAROQUET AUKLET. BJELE-BRUSKI. NAATSCHU.

This bird was rather numerous in Unalga Pass as we approached the harbor of Unalaska, and was met with at Atka, Agattu, and Attu, though in small numbers. One flock of five was seen at Bering Island, off some cliffs west of the town, and we saw these Auklets occasionally in the Kurils as far south as Simushir, where there were a number about the rocks.

ÆTHIA CRISTATELLA (Pallas).

CRESTED AUKLET. KONJUGA. KOROKORA. TURUTURA.

A few Crested Auklets were seen near Unalaska, but at Atka, Attu, and especially at Agattu, they were much more numerous. We saw

a few about the Commander Islands, down the Kamchatkan coast to Cape Lopatka, and among the Kurils, where they were common about Simushir. We saw occasional individuals among the southern Kurils almost as far south as Yezo.

ÆTHIA PYGMÆA (Gmelin).

WHISKERED AUKLET. MALINKA KONJUGA. PETUSCHKA. TURUTURK.

ÆTHIA PUSILLA (Pallas).

LEAST AUKLET.

Owing to my inability positively to distinguish these two species in life, I have thought it best to enter my observations under a double heading. Probably most of my remarks refer to *Æ. pusilla* among the Aleutians and to *Æ. pygmæa* in the Kurils.

Abundant in Unalga Pass, and common about Atka, Attu, and especially Agattu; a number of these small auklets were seen about the Commander Islands, down the Kamchatkan coast, and off the Kurils. They were extremely numerous at sea on the day after leaving Simushir, but after that we did not meet with them.

SYNTHLIBORAMPHUS ANTIQUUS (Gmelin).

ANCIENT MURRELET. STARIK. WINGOROUTSCH.

Ancient Murrelets were very common all about the shores of the Aleutian Islands and in the bays and harbors, being rather more numerous about Atka, Attu, and especially Agattu, than elsewhere; they were rather common about Copper and Bering islands, and a few were noticed along the eastern Kamchatkan coast, and down the Kurils as far as Simushir.

BRACHYRAMPHUS MARMORATUS (Gmelin).

MARBLED MURRELET.

The Marbled Murrelet was first noticed in Puget Sound, where it was rather common as far as Port Townsend; a number were seen in different places in the channel between Vancouver Island and the mainland, especially just before entering Seymour narrows. On reaching the open sea we found these birds very common until it became dark, after which we saw no more until we reached Unalaska, where a number were met with in Unalga Pass and about the rocky shores of the island. A female was secured in the inner harbor, near the Dutch Harbor wharf.

BRACHYRAMPHUS, species.

MURRELET.

A few birds belonging to this genus were seen in Avacha Bay, Kamchatka, and down the coast toward Cape Lopatka; but as none were secured their identity is doubtful.

CEPPHUS CARBO Pallas.

SOOTY GUILLEMOT.

This species was only seen near Sakhalin Island, where a few were found in the outer part of Aniwa Bay, and two pairs on the east coast, near Cape Patience.

CEPPHUS COLUMBA Pallas.

PIGEON GUILLEMOT. KAJURKA. SVISTUN.

The Pigeon Guillemot was very common about Unalaska, as well as about all the other Aleutians which we visited. At Agattu and Attu many scattered pairs were found about the cliffs, where they were probably breeding, although I found no eggs. This bird was common at Copper and Bering islands, and we met with occasional pairs at various places in Bering Sea, near the Bogoslovs among others, and also in the Pacific as much as 200 miles from Unalaska.

CEPPHUS SNOWI Stejneger.

SNOW'S GUILLEMOT.

We found Snow's Guillemot common about Cape Lopatka and down the Kurils as far south as the northern end of Yezo. Although I judged from their actions that these birds were breeding on Simushir, I was not fortunate enough to find any eggs.

Subfamily ALCINÆ.

URIA TROILLE CALIFORNICA (H. Bryant).

CALIFORNIA MURRE.

The California Murre was first seen on the day after leaving San Francisco, and from then on, becoming rather more frequent until we were off the mouth of the Columbia River, where they were abundant in flocks of from six to twenty or more. Many companies were seen sitting on logs which had been brought down by the river. They remained numerous until we were well inside the Straits of Fuca, when their numbers fell off, and they finally disappeared off Port Townsend. In the passage between Vancouver Island and the mainland they were very abundant at the northern end of Georgia Gulf and about the entrance of the Seymour Narrows, but were not seen anywhere else. Between Vancouver Island and Unalaska occasional individuals or pairs were seen, becoming more frequent near Unalga Pass, where they were very common. We found them about all the Aleutian Islands, but apparently much less abundant toward the west and about the Commander Islands. They were very common at sea in the vicinity of the Bogoslovs, as already noticed under *Lunda cirrhata*.

URIA LOMVIA ARRA (Pallas).**PALLAS' MURRE. ARE. HARA.**

We found this species common at Unalaska and thence westward throughout the Aleutian and Commander islands. They were common about Petropaulski, where one was seen near the town, and down the coast to Cape Lopatka. They were frequent at sea off the Kurils, and common near Simushir. We found them rather common about the rocky shores of Yezo between Hakodate and Mororan. On July 16, when we left Hakodate for the Japan Sea, we found them very numerous all along the rocky shores of Yezo, usually singly, but sometimes in flocks of from ten to twenty-five individuals. The single birds at this time were almost always accompanied by a young chick, so small and inconspicuous on the water that its presence would often have been unnoticed had it not been for its shrill whistle. On September 24, in Aniwa Bay, Sakhalin Island, we found murre very common offshore, and we also found them numerous on the first of October along the northern and eastern shores of Yezo and the southern Kuril Islands. Doubtless many of the murre seen about the Bogoslovs, as noted under *Lunda cirrhata*, were of this species.

Order LONGIPENNES.**Family STERCORARIIDÆ.****STERCORARIUS POMARINUS (Temminck).****POMARINE JAEGER.**

A single bird of this species was seen on June 3, on Bower's Bank in Bering Sea. This was the only record for the whole trip.

STERCORARIUS PARASITICUS (Linnaeus).**PARASITIC JAEGER. RASBOJNIE.**

This jaeger was of rather frequent occurrence in Bering Sea, and was met with on Bower's Bank and about the Aleutians. On land I met with it twice, once at Agattu and once on Bering Island. In the Kurils one was seen at sea north of Simushir.

STERCORARIUS LONGICAUDUS Vieillot.**LONG-TAILED JAEGER.**

A Long-tailed Jaeger was seen off the coast of southern Oregon on May 7, another about halfway between Vancouver Island and the Aleutians, and a third on Bower's Bank.

Family LARIDÆ.

Subfamily LARINÆ.

RISSA TRIDACTYLA POLLICARIS Ridgway.

PACIFIC KITTIWAKE. GAVARUSCHKA. KIRUGA. KERŌO.

The Pacific Kittiwake was common in Unalga Pass and in all parts of Bering Sea visited by us, especially on Bower's Bank. A few were seen between Bering Island and Kamchatka, and in the Kurils they were found until we were about half way between Simushir and Yezo.

RISSA BREVIROSTRIS (Bruch).

RED-LEGGED KITTIWAKE. KRASNO-NOGAJA. GAVARUSCHKA.

The Red-legged Kittiwake was seen in small numbers at sea near Unalaska, but became more common in the western part of the Aleutian chain and about the Commander Islands. It was not found in Kamchatka nor in the Kurils.

LARUS BARROVIANUS (Ridgway).

POINT BARROW GULL.

The only Point Barrow Gull observed during the whole trip was on the morning of September 28 while we were anchored in Patience Bay, Sakhalin.

LARUS GLAUDESCENS Naumann.

GLAUCOUS-WINGED GULL. TSCHAIKA.

A few of these gulls were seen about San Francisco Bay the day we left. Two were noticed following the ship on May 7, when we were off the Oregon coast, and another the next day. They were common in all parts of Puget Sound, and abundant about Union Bay, Vancouver Island. We picked them up at sea 20 miles or more south of the Aleutian chain, and found them abundant in Unalga Pass and about Unalaska. They were common at Atka, Attu, and Agattu, especially about the lakes on the last-named island, where several were shot. A few were also noticed about the Commander Islands.

LARUS SCHISTISAGUS Stejneger.

SLATTY-BACKED GULL. OUNEMAS.

I found a few of these gulls in Unalga Pass, near Unalaska, but did not meet with the species again until we reached the Commander Islands, when a few were seen both at Copper and Bering islands. About Petropaulski, however, this species was abundant, and it was also abundant at Simushir, in the Kurils, where I secured eight at a small pond near the sea. One of these birds had two unbroken eggs, apparently of some species of cormorant (*Phalacrocorax*), in its stomach, and another a small octopus. We found this species common about the eastern shore of Sakhalin the latter part of September.

LARUS OCCIDENTALIS Audubon.**WESTERN GULL.**

The Western Gull was common about San Francisco Bay when we left, and several were seen following the ship at different times until we reached Puget Sound, after which we did not meet with this species.

LARUS VEGÆ Palmén.**VEGA GULL.**

This gull was rather common in Unalga Pass, near Unalaska, and was seen again, though not in any numbers, in Avacha Bay, Kamchatka. I have no other records.

LARUS CALIFORNICUS Lawrence.**CALIFORNIA GULL.**

The California Gull was common about the bay when we left San Francisco, and individuals were seen following the ship until we reached the mouth of the Columbia River.

LARUS BRACHYRHYNCHOS Richardson.**SHORT-BILLED GULL.**

This species was rather common off the mouth of the Columbia River, and was also seen in Puget Sound.

LARUS HEERMANNI Cassin.**HEERMANN'S GULL.**

Heermann's Gull was seen occasionally in San Francisco Bay on the day of leaving, but was not met with subsequently.

LARUS CRASSIROSTRIS Vieillot.**JAPANESE BAND-TAILED GULL.**

We first met with this species in Hakodate harbor, where it was abundant about the shipping. I was surprised not to see it in Volcano Bay and about Mororan, but it was common along the west coast of Nipon, especially in Nanao harbor, about Sado Island, the Oki Islands, Matsushima, along the Korean coast, and in the Korean Straits. A few were seen at Nagasaki and Kagoshima, and it was common in Tokyo Bay and about Yokohama. I also saw a few at Otaru (Yezo), and it was common in Aniwa Bay, Sakhalin. When we returned from Sakhalin to Hakodate in October it appeared to be just as common as it had been in June and July.

One of the birds observed at Hakodate had the central pair of rectrices entirely white, making a conspicuous break in the black tail band.

LARUS RIDIBUNDUS BRUNNEICEPHALUS (Jerdon).**EASTERN BLACK-HEADED GULL.**

I found this gull abundant about the large pond behind the town at Petropaulski, and it was occasionally seen about the inner harbor.

LARUS PHILADELPHIA (Ord).**BONAPARTE'S GULL.**

Bonaparte's Gull was a common species in San Francisco Bay when we left, and three small flocks were seen at sea during the afternoon of May 7 off the coast of Oregon. In Puget Sound a small flock was seen as we were passing Port Townsend on our way north. Just as we were entering the Seymour Narrows we saw a large flock of fifty or more of these birds, which is the last record I have for the species.

Subfamily **STERNINÆ.****STERNA PARADISEA** Brünnich.**ARCTIC TERN. MARTISCHKA.**

The Arctic Tern was met with in small numbers about Atka, Agattu, Attu, and once off Semichi. Single individuals were observed on Bower's Bank, off Semisopochnoi, and near Bering Island.

Terns were also met with off the mouth of the Columbia River and sparingly in Puget Sound, but I am not certain of the species.

STERNA SINENSIS Gmelin.**ORIENTAL LESSER TERN.**

A few terns, probably of this species, were seen among the Linschoten Islands, south of Kiusiu.

Order TUBINARES.**Family DIOMEDEIDÆ.**Subfamily **DIOMEDEINÆ.****DIOMEDEA NIGRIPES** Audubon.**BLACK-FOOTED ALBATROSS.**

We picked up the Black-footed Albatross on the first day out from San Francisco, when they were abundant, from four to six or more following the ship all the time until we reached the vicinity of the Columbia River, where they disappeared. We met them again about half an hour after leaving the channel between Vancouver Island and the mainland. Here they were very common, becoming more so as we proceeded west, and reaching their maximum abundance well within sight of the Aleutian Islands. On the day we reached Unalaska, about 20 miles southeast of that island twenty-two of

these birds were collected at the stern of the ship by trailing a piece of meat in the water. When we were within about 10 miles of the island they began to leave, one by one sailing off over the sea out of sight, until, less than half an hour afterward, they were all gone, nor were there any in sight, although the meat was still trailing out astern. It is very remarkable that this species should never be found in any of the enclosed seas bordering the north Pacific, in all of which *D. albatrus* occurs, especially as it is common to within sight of the islands separating those seas from the ocean.

On June 6 a Black-footed Albatross was seen just before coming to anchor in Agattu, about 20 miles offshore; on the 12th, between Attu and Copper Island, one was noticed about the stern in the morning, and two in the afternoon. On June 25 we saw a number between Simushir and Yezo, and again on October 1 they were common off the northern coast of Yezo, but only on the Pacific side of the Kuril chain.

We next met with this species on the first day out from Yokohama, homeward bound, and the birds followed us continuously until we were near the island of Kauai, when they disappeared, to reappear again just east of Molokai, after which they remained common until we were near the Californian coast. They were not nearly so abundant in this part of the Pacific as in the northeast, from California north to Alaska.

Specimens of this bird were obtained about 70 miles west of the Queen Charlotte Islands, at sea. The birds were shot from the ship and picked up by means of a small boat. The uninjured members of the flock, a dozen or more in number, were exceedingly tame, and would remain on the water until the boat was within a few feet of them before taking wing.

I examined carefully with a glass all the dark-colored albatrosses which came within range of the ship, as there was a possibility of the occurrence of *Phæbetria palpebrata* (Forster) (= *fuliginosa* of authors) in these waters, it having been recorded from the coast of Oregon; but as it is easily distinguishable on the wing both from *D. nigripes* and immature *D. albatrus*, I have no hesitation in referring all the birds seen in this region to one or the other of these last two species.

DIOMEDEA ALBATRUS Pallas.

SHORT-TAILED ALBATROSS. ALBATROS. PONGAPITE. ATO.

We first saw this species about 200 miles east of Unalaska on the day before our arrival at Dutch Harbor. On the next day two were seen near the Aleutian chain, one of them within 5 miles of the islands. Two more were seen between Attu and Copper Island on June 12; on the 20th one was observed about 20 miles off the Kamchatkan coast, and the next day another in the Okhotsk Sea, near

the mouth of the Aangan River. On October 1 this species was very common about the southern end of the Kurils, on both the inside and outside of the chain.

From these meager notes one might infer that the Short-tailed Albatross was rather rare in the north Pacific, but I believe rather the contrary is the case. Unlike *D. nigripes*, this species is exceedingly shy at sea, and under ordinary circumstances keeps at a very considerable distance from ships, so that it stands much less chance of being observed than that species.

DIOMEDEA IMMUTABILIS Rothschild.

LAYSAN ALBATROSS.

On November 12, two days after leaving Yokohama for Honolulu, a white albatross was observed, apparently darker above than *D. albatrus*; during the succeeding days it became more common until we reached the island of Kauai, after which we did not meet with it. Most probably the species was *D. immutabilis* of Laysan.

Subfamily FULMARINÆ.

FULMARUS GLACIALIS GLUPISCHA Stejneger.

PACIFIC FULMAR. GLUPESCH.

The Pacific Fulmar was first seen the day after leaving San Francisco, when a single individual was observed. The next day several were seen; subsequently they became more and more common until we were off the mouth of the Columbia River, where they were abundant in flocks of sometimes as many as 40 or 50 individuals. After entering Puget Sound no more were seen until we again reached the open sea, where they were common and remained so until we were near Unalaska, when their number fell off. Only a few were seen about that island, and occasional ones in the different parts of Bering Sea which we visited. Rather more were seen on Bower's Bank and off Semisopochnoi than elsewhere. Except for three seen between Agattu and Attu (off Semichi) none were observed until we left Attu for Copper Island, when they reappeared. We found them very common about the cliffs of Copper Island near the town, and they were also rather common about Bering Island. They were numerous along the Kamchatkan coast to Cape Lopatka, and abundant on the cod banks in the Okhotsk Sea, where a hundred or more were observed about the cod-fishing barkentine *S. N. Castle*, which was lying there at anchor. Of all this large flock only two were in the white plumage, the proportion of light to dark birds being very much less on the Asiatic than on the American side of the north Pacific. This fulmar was common in the Kurils, and we saw it until the day before reaching Hakodate. It was not observed about Simushir, however; but at Milne Bay, where we anchored, there are no cliffs suitable

for a nesting site. In La Pérouse Strait we next saw this species, and found it common along the east coast of Sakhalin and across the Okhotsk Sea to the southern Kurils, where, on October 1, it was very abundant. On November 11, the first day out of Yokohama, homeward bound, we again saw the Pacific Fulmar, but only one or two individuals; others were observed on the 12th and 13th, and again on December 10, off the Californian coast.

FULMARUS RODGERSII Cassin.

RODGERS' FULMAR.

Rodgers' Fulmar was identified with certainty only on a few occasions, and only between Vancouver Island and Unalaska. A fine example came within a few feet of me when I was out in a small boat 70 miles west of the Queen Charlotte Islands, and several were seen in the wake of the ship in company with *F. glacialis glupischae*.

Subfamily PUFFININÆ.

PUFFINUS GRISEUS (Gmelin).

SOOTY SHEARWATER.

On September 26, when southeast of Cape Patience, Sakhalin, a number of these birds were observed. I have no other records.

PUFFINUS TENUIROSTRIS (Temminck).

SLENDER-BILLED SHEARWATER. TSCHORNJ GLUPISCH.

I saw this bird only once, on September 30, in the Okhotsk Sea, near the southern Kurils.

PUFFINUS LEUCOMELAS Temminck.

TEMMINCK'S SHEARWATER.

This was the only sea-bird seen in the Japan Sea, where it appeared to be not uncommon. We rarely saw more than six or eight in a day, however, but this was probably due to the fact that, like *Diomedea albatrus*, this species will not ordinarily come near a ship, acting rather as if repelled by its presence. We found this bird in every part of the Japan Sea south of the straits of Tsugaru; about Sado and the Oki Islands, Matsushima, and along the Korean coast. South of the Korean Straits it became rather more common, especially among the Linschoten Islands. From Kagoshima to Yokohama along the southern coast of Japan we found this species in considerable numbers, especially off the little harbor at Oshima Ko, where we saw flocks of fifty or more individuals. We did not meet with this bird east of Sagami Bay.

BULWERIA BULWERI Jardine and Selby.**BULWER'S PETREL.**

Bulwer's Petrel was rather common among the Linschoten Islands, off the southern end of Kiusiu, and also among the Seven Islands south of Yokohama. I was able to recognize this interesting species at once, having previously made its acquaintance among the Azores and between the Azores and Gibraltar.

Subfamily PROCELLARIINÆ.

OCEANODROMA FURCATA (Gmelin).**FORK-TAILED PETREL. STURMOFKA.**

The Fork-tailed Petrel appeared as soon as we were well out to sea after leaving the channel between Vancouver Island and the mainland, rapidly becoming more common as we approached the Aleutians, until the day before reaching Unalaska, when they were very abundant. They were common in Unalga Pass, and we found them on Bower's Bank and commonly about all the Aleutians, and as far west as Copper Island. On Agattu they were apparently breeding in holes along the sides of a deep ravine which makes in from the sea at Macdonald Bay, most of them being met with more than a quarter of a mile inland. They were frequently seen flying up and down this ravine to and from the sea, and entering and leaving burrows in its sides. We did not see these birds after leaving Copper Island, where they were common, until we reached the Kurils, where they were again rather numerous until we were south of Simushir, after which this species was not met with again.

OCEANODROMA LEUCORHOA (Vieillot).**LEACH'S PETREL. MALINKA TSCHORNAJA STURMOFKA.**

Leach's Petrel was noticed shortly after leaving the channel between Vancouver Island and the mainland, and was occasionally seen all the way up to the Aleutians, although never as common as *O. furcata*. About the islands they were sometimes seen by day, but not very often; at night, however, they were attracted by the lights of the ship and could be heard chirping all about, like so many bats. Doubtless *O. furcata* was common at night about the ship also, but as all the birds which were caught on board were of the present species I can make no positive statement that such was the case, although I have examined specimens of the latter species taken on shipboard at night at Kiska. After leaving Copper Island, where the species was not uncommon, we did not see it again until we were south of Paramushir, where it became again common until we were well south of Simushir. The greatest number heard on any

one night was about 100 miles northeast of the last-named island. On August 16, in the Linschoten Islands, a single bird, apparently of this species, was observed.

Salvin ^a mentions a specimen from the Kurils in the British Museum with some white at the base of the outer rectrices and also along the outer web of the outermost feathers. A specimen from Copper Island in my collection exhibits this peculiarity, but Kurilian birds have no more white on the tail than others in the National Museum collection from the North Atlantic; so I believe it to be merely a case of individual variation, as, except for this one example, there is no difference between my birds and a series from the north Atlantic.

OCEANODROMA HOMOCHROA (Couses).

ASHY PETREL.

A few of these birds were seen when we were well out from San Francisco, and occasionally during the next day.

Order STEGANOPODES.

Family PHAETHONTIDÆ.

PHAETHON CANDIDUS (Draper).

WHITE TROPIC BIRD.

On August 15, when we were in the Linschoten Islands, two pairs and a single bird of this species, at different times, came close to the ship and, after circling about a few times, disappeared in the direction of the islands.

PHAETHON RUBRICAUDA Boddaert.

RED-TAILED TROPIC BIRD.

One example of this handsome species was observed on August 14, while we were in the Linschoten Islands. It can hardly be doubted that both these species are much more common about southern Japan than is commonly supposed.

Family SULIDÆ.

SULA LEUCOGASTRA Boddaert.

BOOBY.

A single Booby passed low over the bows of the ship in the afternoon of August 14, when we were among the Linschoten Islands. It was the only one seen.

So far as I know, this group of islands has never been visited by an ornithologist. From their geographical position, as well as the greatly diversified conditions which obtain there, it would be surprising if a thorough survey did not yield extremely interesting results.

^a Cat. Birds Brit. Mus., vol. 25, 1896, p. 349.

Family PHALACROCORACIDÆ.^a**PHALACROCORAX FILAMENTOSUS** Temminck and Schlegel.**TEMMINCK'S CORMORANT.**

What was probably this species was very common about the shores of Matsushima at the time of our visit.

PHALACROCORAX AURITUS ALBOCILIATUS Ridgway.**FARRALONE CORMORANT.**

It being impossible to separate this from the following form in observations taken on shipboard, I have arbitrarily placed my records from San Francisco to Puget Sound under the present heading, and the notes from Puget Sound north under *P. a. cincinatus* as roughly representing the distribution of the two subspecies at the time of my visit.

This cormorant was seen near the entrance of San Francisco Bay, and was common outside. We met with it at sea all along the coast, and it was abundant off the mouth of the Columbia River.

PHALACROCORAX AURITUS CINCINATUS (Brandt).**WHITE-CRESTED CORMORANT.**

Double-crested cormorants were very common in Puget Sound up to Port Townsend, but less so from there on. They were occasionally seen, however, about Dockton, and two were noticed in Union Bay, Vancouver Island. I have a note of a few being seen in Unalga Pass near Unalaska, and I found them at Atka, Attu, and Agattu.

PHALACROCORAX PENICILLATUS (Brandt).**BRANDT'S CORMORANT.**

This bird was common about San Francisco Bay when we left, and was seen along the coast rather commonly as far north as the Columbia River.

PHALACROCORAX PELAGICUS RESPLENDENS Audubon.**BAIRD'S CORMORANT.**

We found this cormorant common about the Golden Gate, and abundant all the way up to Puget Sound. On the second day out we passed two flocks, one of fifty or more and the other of upward of one hundred and fifty individuals. It was very abundant off the

PHALACROCORAX PERSPICILLATUS Pallas.**PALLAS' CORMORANT.**

I had hoped that some trace of this magnificent species, which formerly occurred on Bering Island, might be found on some of the little-known islands and rocks at the extreme western end of the Aleutian chain, but in this I was disappointed. It is undoubtedly quite extinct.

mouth of the Columbia River in large flocks, and was common in Puget Sound as far as Port Townsend, where the numbers fell off and the bird gradually disappeared.

PHALACROCORAX PELAGICUS PELAGICUS Pallas.

PELAGIC CORMORANT. MALINKIJ URIL.

This bird was very common about the Aleutians, being first seen in Unalga Pass near Unalaska, and from then on commonly whenever we were near land. It was especially abundant about Agattu and off Semichi, and we found it at Copper and Bering islands, frequently along the coast of Kamchatka, and down the Kurils as far as Simushir, about the cliffs of which island a number were seen. Probably they were breeding here, as in the stomach of a gull (*Larus schistisagus*) I found two cormorant's eggs, possibly belonging to this species.

PHALACROCORAX URILE (Gmelin).

RED-FACED CORMORANT. BOLSCHOJ URIL.

I only identified this species with certainty a few times; near Agattu, near Bering Island, near Cape Lopatka, and once in the northern Kurils, where a specimen flew across the bow of the ship within a few feet of me.

Order ANSERES.

Family ANATIDÆ.

Subfamily MERGINÆ.

MERGUS AMERICANUS (Cassin).

AMERICAN MERGANSER.

I have one record for this species. A male was seen on May 26 on a small pond near Dutch Harbor, Unalaska, and another, possibly the same bird, was seen at the same place on the next day. A bird probably of this species was seen on one of the lakes at Agattu.

MERGUS MERGANSER MERGANSER (Linnaeus).

GOOSANDER. MERGANSER. BOLSCHOJ KRACHAL. TUIPE.

A pair of these birds was found on a large pond near Milne Bay, Simushir.

MERGUS SERRATOR (Linnaeus).

RED-BREADED MERGANSER. KRACHAL.

A small flock of Red-breasted Mergansers was seen in the outer bay at Unalaska on May 25.

Subfamily ANATINÆ.

ANAS PLATYRHYNCHOS Linnaeus.

MALLARD. SELESENW. SA'ANGITSCH. SAATSCHITSCH.

The Mallard was common in the large swamp near Nikolskoi, Bering Island, but I saw it nowhere else.

NETTION CRECCA (Linnaeus).

TEAL. TSCHIROK.

Some of these teal were observed in the swamp on Bering Island.

NETTION CAROLINENSIS (Gmelin).

GREEN-WINGED TEAL.

I have a note that a bird of this species was seen at Unalaska on May 25.

DAPILA ACUTA (Linnaeus).

PINTAIL. VOSTROCHEVOST. PAKARICHU. CLAGI.

I noticed a few birds of this species in the large swamp near the town of Nikolskoi, Bering Island.

Subfamily FULIGULINÆ.

MARILA MARILA (Linnaeus).

SCAUP. TSCHERNIK.

The scaup was abundant in Puget Sound, up to and past Port Townsend, but we did not find it in the more narrow portions. It was, however, common about Union Bay, and occasionally seen in the inland passage wherever it widened out. It was rather common at Atka and Agattu.

AYTHYA VALLISNERIA (Wilson).

CANVAS-BACK.

We only noticed the Canvas-back in Puget Sound, where it was rather common in the wider reaches before we reached Port Townsend.

HARELDA HYEMALIS (Linnaeus).

OLD-SQUAW. SAKKA. AANGA.

I obtained an adult male of this species in breeding plumage at Simushir on June 23. It was extremely emaciated and apparently unable to fly. A tumor about an inch and a half long in the body cavity probably accounted for the bird's condition. The testicles were not enlarged.

HISTRIONICUS HISTRIONICUS (Linnaeus).**HARLEQUIN DUCK. KAMENUSCHKA.**

The Harlequin Duck was very common at Unalaska about the rocky shores, usually in small flocks. It was common about Atka, where one or two were seen inland on a small stream; on Attu and Agattu it was also numerous on the streams as well as along the coast; a number were seen at Copper and Bering islands, and a few at Simushir in the Kurils.

SOMATERIA V-NIGRA Gray.**PACIFIC EIDER. PIETRAK.**

The Pacific Eider was common at Agattu and Attu. On the former island a nest with four eggs was found near the beach on June 8. This bird was usually seen along the rocky portions of the shore, and was particularly numerous about Macdonald Bay, Agattu, and the entrance of the harbor at Attu.

OIDEMIA AMERICANA Swainson.**AMERICAN SCOTER.**

This scoter was seen in Puget Sound and about Union Bay, Vancouver Island, but was not nearly so abundant as *O. deglandii* or *O. perspicillata*.

OIDEMIA STEJNEGERI Ridgway.**STEJNEGER'S SCOTER. TURPAN.**

On September 30 and October 1, when among the small low islands northeast of Yezo, and the southernmost Kurils, we found these ducks very common, usually in small flocks. As they were not seen at this point when we passed in the summer, I judged these birds to be migrants on their way south. We did not find them about the other Kurils nor about Kamchatka.

OIDEMIA DEGLANDII Bonaparte.**WHITE-WINGED SCOTER.**

We saw a few White-winged Scoters on May 7 off the Oregon coast, and on the next day found them abundant off the mouth of the Columbia River. They were common everywhere in Puget Sound, and very abundant at the time of our visit at Union Bay, Vancouver Island, far outnumbering any other duck. I saw a single pair in Unalga Pass, but did not meet with it again in the Aleutians.

OIDEMIA PERSPICILLATA (Linnaeus).**SURF SCOTER.**

In Puget Sound this duck was common, although not so abundant as *O. deglandii*; it was common at Union Bay, and a few were seen

at Attu and Agattu. It was also rather common at sea when we were off the mouth of the Columbia River.

Subfamily ANSERINÆ.

BRANTA CANADENSIS HUTCHINSHI (Richards).

HUTCHINS' GOOSE.

This goose is the most abundant bird on Agattu, where it breeds by thousands. When we approached the shore we saw a number of geese flying about the cliffs and bluffs, and soaring in circles high in air. On landing I walked up the beach to the left and soon came to a small stream which enters the sea through a gap in the high bluffs, when I saw fifty or more of these birds along the bank preening their feathers. From this point I walked inland over the rough pasture-like country toward a lake where this stream rises. Geese were seen on all sides in great abundance, walking about the grassy hillsides in companies of six or eight to a dozen, or flying about from one place to another. When on the ground they were comparatively shy; at about 100 yards distant they would stop feeding and watch my movements; at about 50 yards they generally took wing; but instead of flying away they would circle about and fly toward me, often not more than 10 feet over my head, as if to see what sort of a strange beast it was which thus intruded on their domains. I shot nine, using merely a very light charge of powder with an ounce of No. 10 shot which I had brought with me for the purpose of securing specimens of song sparrows (*Melospiza*) and longspurs (*Calcaricus*); even with that light load I secured two at one discharge of my 12-bore. I believe I could have killed a hundred or more in the course of a morning's walk had there been any object in so doing. The actions of these geese on this seldom visited and desolate island reminded me of the accounts given by travelers who have visited Kerguelen of the habits of the native teal (*Dafilula eatoni*) there. Although common on the seashore, these geese were more abundant inland, especially in marshy places, and where there was an abundant growth of long rank grass.

When I had gone inland between a mile and a mile and a half from the sea, a recall was blown from the ship, as a strong breeze had come up from the sea which made the anchorage unsafe, and I was forced to take a bee line to the beach, abandoning my geese, which I had "cached" along the route by which I had come, to be picked up on my return. On reaching the beach I sent a sailor back to my nearest pile of birds, consisting of four of these geese, three *Larus glaucescens*, some puffins (*Lunda cirrhata*) and other Alcidae, and a few ducks, and he soon returned with the geese and gulls. I found it impossible to prepare the skins of any large birds that evening, so they were stowed away until such a time as I could find leisure

to attend to them. The next day I found that, owing to their having been placed near some steam pipes, the geese were too far gone for preservation, and I was reluctantly obliged to throw them away. I took color notes and measurements of each specimen, however, which may prove of interest.

No. 1. Dimensions: Wing 14.90 inches; tail 5.75 inches; rectrices 16. White cheek patches confluent on throat, with a few scattered dark feathers in the median line; white collar about lower neck continuous all around, but only about half an inch wide; white of anal region sharply marked off from brown of breast and abdomen.

No. 2. Wing 15.75 inches; tail 5.62 inches; rectrices 16; white cheek patches divided for their anterior half by a black peninsula three-quarters of an inch wide at the base, narrowing to five-eighths of an inch at its end, and a row of scattered black specks from the end of the peninsula to the posterior border of the cheek patches in the median line of the throat; collar on lower neck 1 inch wide, but narrowing toward dorsal surface, where it is crossed by a bar of black, one-quarter of an inch in width, in the median line; underparts as in No. 1.

No. 3. Wing 16.12 inches; tail 5 inches; rectrices 14; cheek patches divided for their anterior half as in No. 2; white collar on lower neck three-quarters of an inch wide in front, decreasing in width toward dorsal surface, where it is crossed by a bar of black; underparts as in Nos. 1 and 2.

No. 4. Wing 15.25 inches; tail 5.50 inches; rectrices 16; cheek patches small, and entirely separated by an isthmus three-quarters of an inch wide at the anterior and posterior ends, narrowing to one-half an inch in the middle; white collar on lower neck one-quarter of an inch wide in front, narrowing behind, where it is much broken up and divided by a black bar in the median line; upper surface somewhat darker than the lower, the other birds having been uniformly colored; this specimen was also slightly darker throughout, and was apparently brooding, a large patch on the breast being bare of feathers.

In a patch of long grass near the top of a bluff just behind the beach I found a nest containing three eggs belonging to this species.

At Attu I found this goose not uncommon, but they do not breed there. Several were seen on a small islet to the right of the harbor entrance, and others flying overhead at various places in the lowlands. The natives here told me of their breeding in great abundance on Agattu, and also in lesser numbers at Semichi, and they also said that the ravens on those islands steal their eggs and bury them for winter consumption. The absence of foxes from Agattu and Semichi undoubtedly accounts for the occurrence of this species on these islands in such abundance.

Order HERODIONES.

Suborder HERODIL.

Family ARDEIDÆ.

Subfamily ARDEINÆ.

ARDEA HERODIAS FANNINI Chapman.

NORTHWEST COAST HERON.

This bird was observed several times about Union Bay, Vancouver Island.

ARDEA, species.

HERON.

Heron were seen at various places along the Japanese coast, at the Oki Islands, Matsushima, and in the Linschoten Islands. One was also seen on October 1 among the small islands northeast of Yezo. As no specimens were obtained, their identity is uncertain, though I am almost sure that the last was an example of *Ardea cinerea jouyi*.

Order PALUDICOLÆ.

Suborder GRUES.

Family GRUIDÆ.

GRUS CANADENSIS (Linnaeus).

LITTLE BROWN CRANE.

On the morning of June 8 while ashore on Agattu Island I encountered a pair of these birds, but could not succeed in getting anywhere near them. On being flushed they never flew for any great distance, but always alighted far out in the open pasture-like areas, out of reach from any rocks or other suitable cover. I tried twice to creep up on them under the lee of some small hills, only to find that they had walked a long way from the spot where they had settled, and I therefore gave up the chase as hopeless.

Order LIMICOLÆ.

Family PHALAROPODIDÆ.

PHALAROPUS FULICARIUS (Linnaeus).

RED PHALAROPE.

The only time I observed this bird was just before reaching Unalaska. On the morning of the day we reached that island thousands of these birds were seen, mostly in flocks of from fifty to a hundred or more,

but many singly or in small companies. Most of the birds were flying about in an aimless sort of way, but many were on the water. When we were about 5 miles from the coast the birds began to get less frequent and finally disappeared.

LOBIPES LOBATUS (Linnaeus).

NORTHERN PHALAROPE.

The Northern Phalarope was common on the pools in the marshes on Bering Island, but was not met with anywhere else.

Family SCOLOPACIDÆ.

ARQUATELLA MARITIMA COUESI Ridgway.

ALEUTIAN SANDPIPER. LAJDINIJ KULIK.

The Aleutian Sandpiper was very common on the Aleutian Islands, especially at Atka, Agattu, and Attu, and was also found on the Commander Islands. It frequents the more rocky portions of the shores, where it is usually very tame, and is abundant in the inland marshy districts and along the swampy banks of the streams. The cry is loud and clear, bearing a striking resemblance to the call of the Flicker (*Colaptes auratus*). At Attu and Agattu I found them most abundant, occurring everywhere in the marshy lowlands and along the shore, singly or in pairs. At Attu, although more common in the lowlands than anywhere else, they were found high up on the mountains wherever the snow had melted sufficiently to uncover the moss underneath. They were frequently seen about a large bare patch on the summit of one of the mountains to the left of the harbor entrance. On the side of one of these mountains, 700 feet or more above the valley, I found a nest of this species with four eggs, near an extensive patch of snow. The nest was deep cup-shaped, with the edges even with the surrounding moss; the eggs were brownish olive, rather dark, spotted and blotched, chiefly at the larger end, with deep brown and purplish gray.

PISOBIA DAMACENSIS (Hornfield).

LONG-TOED STINT.

I found this trim little species rather common in the large swamp at Bering Island, where specimens were secured.

HETERACTITIS INCANUS (Gmelin).

WANDERING TATLER. TSCHORNIJ KULIK.

This species was seen at Unalaska near Dutch Harbor, at Agattu, and at Attu, but was nowhere common. The specimens brought back are from Unalaska.

Family APHRIZIDÆ.

ARENARIA MELANOCEPHALA (Vigors).

BLACK TURNSTONE. KIDMALGIK.

On the first day out of San Francisco, May 4, we saw several small flocks of these birds on their way north; each succeeding day they became more abundant until on the afternoon of May 8 we saw them by thousands, in flocks of from ten or twenty to several hundred. At one time, about 2 o'clock in the afternoon, the whole sea appeared dotted with white, so abundant were they: All the birds noticed were headed up the coast, going the same direction as we.

In the mornings these birds were comparatively rare; they began to appear about 11, and increased in numbers until about 2, when they were very abundant; shortly after 3 there was a falling off until by half past 4 few, if any, were to be seen. This was true every day we were at sea on the voyage from San Francisco to Puget Sound. Whether they spent the night and early morning on the neighboring shores or resting on the water I am unable to say; but all we saw were on the wing; possibly there were other shore birds in these multitudes, but all which came near the ship were of this species.

Order GALLINÆ.

Suborder PHASIANI.

Family TETRAONIDÆ.

Subfamily TETRAONINÆ.

BONASA UMBELLUS SABINI (Douglas).

OREGON RUFFED GROUSE.

I never found ruffed grouse nearly so common as this subspecies was about Union Bay, Vancouver Island. They were abundant in all the wooded districts, and the males were heard drumming on all sides.

LAGOPUS LAGOPUS ALEXANDRÆ J. Grinnell.

ALEXANDER'S WILLOW PTARMIGAN.

Lagopus lagopus alexandræ J. GRINNELL, Univ. of California Publ., Zool., vol. 5, 1909, No. 2, p. 204 (Feb. 18).

In the course of my work upon the collections which I made while on the *Albatross*, I had occasion to enter rather deeply into the question of the recognizable forms belonging to the willow ptarmigan group in North America. The results from this study were not entirely satisfactory, owing to the absence of material from certain important intermediate districts, and of specimens from all localities in strictly comparable plumages, so the work was temporarily laid aside until further material might become available. Mr. Joseph

Grinnell had, in the course of his work on Alaskan birds, become interested in the problem presented by the willow ptarmigan. I explained to him the general results which I had attained from the study of the material in Washington, and urged him to name the southern Alaskan form, which he has done. As I have had no opportunity of again taking up the question, I give in the following paragraphs, without change, the notes I made in 1907, hoping that they may prove of some value.

A careful examination of the material available in Washington, consisting of 115 specimens of North American willow ptarmigan, has convinced me that there are at least two well-marked forms of this bird inhabiting the country, in addition to the subspecies found in Newfoundland (*Lagopus lagopus alleni* Stejneger), which appear to be readily distinguishable from birds from Norway. I have not been able to examine specimens from eastern North America, south of Labrador, except from Newfoundland, but the indications are that a race inhabits this district which is similar to *Lagopus lagopus alexandræ*, but which will probably turn out to be a new form peculiar to the region.

There seem to be slight, but apparently constant, differences between birds from various parts of the northwest, which I have considered collectively as *Lagopus lagopus alexandræ*. For instance, the bird inhabiting the mountains of southeastern Alaska differs from that of the coasts of the Alaska peninsula and the islands adjacent, while these, again, are not quite the same as others from the coast of Norton Sound. With but 32 specimens from the entire Territory of Alaska, however, I cannot hope to solve the problem. At any rate, although perfectly distinct from *L. l. albus*, *L. l. alexandræ* exhibits much more plasticity than the well-marked and comparatively stable northern form. The color comparisons were made from 12 specimens from the Shumagin Islands and 6 from Alaska in the perfected spring plumage, and over twice as many from northern Labrador, taken at the same time and apparently in the same plumage.

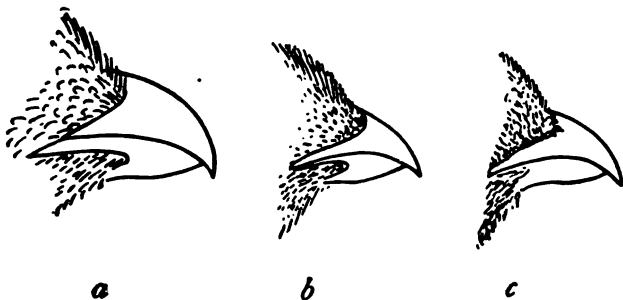
I have examined specimens from the following localities: Twenty from Newfoundland, 60 from Labrador, 3 from central arctic North America, 18 from the mainland of Alaska, 2 from Kadiak Island, and 12 from the Shumagin Islands. Three examples from Norway were regarded as true *Lagopus lagopus lagopus*.

Of these specimens, all those from Labrador and central arctic America, with others from Point Barrow, Kotzebue Sound, Cape Lisbourne, Kowak River, Yukon River, and near St. Michaels, belong to a well-differentiated race, with the beak very large, high, and stout, the culmen strongly arched, and usually with a prominent ridge from the inferior corner of the maxilla to in front of the nostril. They are identical among themselves, it being impossible to tell from the ex-

amination of any one specimen whether it was taken in Alaska or in Labrador. A number of young birds in various stages from Labrador, besides the 60 adults examined, show that this character of the large beak is assumed at a very early age. My Norwegian specimens have very small beaks, not noticeably larger than those of *Lagopus mutus* from the same locality.

In regard to the nomenclature, Gmelin, in 1788,^a based the name [*Tetrao*] *albus* upon the "Lagopède de la Baye d'Hudson" of Buffon,^b which is unmistakably this form. The other references cited by Gmelin under this species, as well as under his [*Tetrao*] *lagopus* of the previous page, include old and new world forms of both the *Lagopus lagopus* and *Lagopus mutus* groups jumbled together.

This form should be known, therefore, as *Lagopus lagopus albus*, the type-locality being Hudson's Bay, and the habitat from northern Labrador westward and northwestward, reaching the Alaskan shores



SUBSPECIES OF *LAGOPUS LAGOPUS*. a. *LAGOPUS LAGOPUS ALBUS* (FROM A SPECIMEN FROM UNGAVA). b. *LAGOPUS LAGOPUS ALEXANDRÆ* (FROM A SPECIMEN FROM THE SHUMAGIN ISLANDS). c. *LAGOPUS LAGOPUS* (FROM A SPECIMEN FROM NORWAY).

of the Arctic Ocean south in Alaska to parts of the lower Yukon valley and St. Michaels.

Lagopus lagopus alexandræ is a somewhat smaller form, with a much smaller and weaker beak, the culmen regularly curved as in *L. l. lagopus*. The general coloration above is deep rich chestnut, thickly and finely vermiculated with black, each feather narrowly tipped with white; upper throat and face dusky; sides of head and neck, lower throat, and fore neck clear chestnut, the breast becoming finely vermiculated with black, increasing in extent posteriorly; sides and flanks very dark and clouded with blackish, the feathers tipped with buff; most of wings and under tail-coverts, middle of underparts, thighs, and feet, white.

Measurements (average): Wing 193 mm.; tail 120 mm.; tarsus 38 mm.; middle toe 28.5 mm.; culmen 17.5 mm.; depth of bill at base 12 mm.; distance from inferior corner of maxilla to tip of culmen 21.5 mm.; width of bill at base 12 mm.

^a Syst. Nat., vol. 1, pt. 2, p. 750.

^b Hist. Nat. Ois., vol. 2, 1771, p. 276 [but not pl. 9].

Judging from my material this appears to be a more richly colored, darker, more finely marked form than *L. l. albus*, the markings above finer, with much less rufous, and the lower part of the præpectus finely vermiculated, instead of clouded with black.

The single specimen in my collection was obtained by Mr. F. M. Chamberlain on July 13, 1905, on Twin Rift Peak above McDonald Lake in southeastern Alaska, at an elevation of about 3,000 feet. It is a male bird, and was followed by a brood of young at the time of capture, although the ground was still covered with patches of snow.

This bird differs in some respects from the series of *L. l. alexandræ* from other parts of Alaska; the culmen is strongly curved toward the tip instead of regularly curved for its entire length, and the general coloration is darker and more rufous, the feathers above tipped with buff instead of white. It measures: Wing 190 mm.; tail 117 mm.; tarsus 39 mm.; middle toe 27 mm.; culmen 19 mm.; depth of bill 11 mm.; distance from inferior corner of maxilla to tip of culmen 23 mm.; width of bill at base 12 mm. It is possible that it may represent a new race peculiar to the mountains of southeastern Alaska, but a large series will be necessary definitely to determine this point.

KEY TO THE AMERICAN SUBSPECIES OF LAGOPUS LAGOPUS.

I. Shafts of primaries and secondaries black; primaries conspicuously marked with black in distal portion (*Newfoundland*).

Lagopus lagopus alleni (Stejneger).

II. Shafts of secondaries, and usually of primaries, white; no black markings on primaries.

a. Bill very large, high, and stout, culmen strongly curved; size large (wing about 196 mm.; tail 125 mm.; tarsus 40 mm.); coloration above dusky, coarsely vermiculated with rufous and grayish buff (*northern Labrador, westward and northwestward to northern Alaska, reaching Point Barrow, Kotzebue Sound, Cape Lisbourne, and Kowak River*).

Lagopus lagopus albus ^a (Gmelin).

b. Bill moderate, culmen regularly curved; size smaller (wing about 193 mm.; tail 120 mm.; tarsus 38 mm.); coloration above chestnut, vermiculated with black, and sometimes also with buff (*southern Alaska, from coasts of Norton Sound and Alaska Peninsula, including Kadiak and the Shumagin Islands, southeastward to mountains of southeastern Alaska*).

Lagopus lagopus alexandræ J. Grinnell.

LAGOPUS LAGOPUS, subspecies.

WILLOW PTARMIGAN.

Some form of Willow Ptarmigan was found to be not uncommon in the lowlands behind Petropaulski, Kamchatka, but the birds were very shy and I did not succeed in getting any specimens.

^a *Type-locality*.—Hudson Bay.

LAGOPUS RUPESTRIS NELSONI Stejneger.**NELSON'S PTARMIGAN.**

I found this bird rather common about the summit of the mountain on Dutch Harbor Island, Unalaska, and also saw it frequently on the lower slopes, except in the immediate vicinity of Dutch Harbor. At the time of my visit the birds were mostly paired, and were very shy, rarely allowing a near approach. Most of the birds were in the dark plumage, but many were mottled with white and one was noticed almost entirely white. The males were very noisy, and their croaking could be heard on all sides; several were seen to fly up into the air to a considerable height and then sail down, emitting their peculiar croaking rattle. The powers of flight possessed by these birds is very great; few that were flushed alighted within half a mile, and several flew directly out across the bay toward the mountains on the other side, over two miles away. Practically all the birds seen were on or in the immediate vicinity of snow, none being found in the comparatively level grassy districts near the towns of Dutch Harbor or Unalaska, where the snow had all melted. On the rugged northeastern end of Dutch Harbor Island, however, the birds were found on the mossy lower slopes, and one or two on the seacoast itself about the mouth of snow-filled ravines. The six specimens obtained are all typical and exhibit no peculiarities.

LAGOPUS RUPESTRIS ATKHENSIS (Turner).**TURNER'S PTARMIGAN.**

At Atka I was much surprised to find ptarmigan abundant all over the grassy lowlands, and none at all even on the lower slopes of the mountain, just the reverse of my experience at Unalaska. As on that island, the birds were usually in pairs and very shy, rising a long distance away. Their white wings made them very conspicuous. They never went far after being flushed, however, and, the ground being fairly level, it was usually possible to obtain a second shot. Ptarmigan appear to be much more numerous here than at Unalaska, occurring even in the vicinity of the town, and I had no trouble in securing all the specimens I wished.

LAGOPUS EVERMANNI Elliot.**ATTU PTARMIGAN.**

I did not find this bird at all common on Attu, doubtless because I did not succeed in locating its favorite haunts. During an entire day's trip over the mountains on the right of the harbor, behind the town, and about the large lake at the summer encampment only three were seen, one in the mountains above the lake and two in the

lowlands between the town and the lake. All three were shot. On arriving at the ship one of the men told me he had never seen ptarmigan so common as about the summit of the mountains at the left of the harbor entrance. As he had had considerable experience with ptarmigan in seldom visited portions of Alaska, and was a reliable man, I arranged to visit the locality the next day with him as a guide in order to obtain a series of this little known species. We started early and reached the place a little before noon, but, although the droppings of the birds were extremely abundant everywhere, we saw none of the birds themselves. Just as we were preparing to leave, after searching the whole district thoroughly, a fine cock came flying over from one of the neighboring peaks and was promptly secured. On our way back to the shore we saw one other which was chased for over a mile but without success. The only male specimen taken is darker than any in the National Museum collection, being sooty black with but few traces of rusty vermiculations.

LAGOPUS RIDGWAYI Stejneger.

RIDGWAY'S PTARMIGAN. KUROPATKA.

Although we searched the mountains about the town on Copper Island carefully, we found none of these birds and only a very few of their droppings; at Bering Island we also failed to find them, our search, however, being limited to the lowlands behind the town. The birds are, nevertheless, common in certain parts of both islands.

Order COLUMBÆ.

Family COLUMBIDÆ.

COLUMBA FASCIATA Say.

BAND-TAILED PIGEON.

A small flock of Band-tailed Pigeons was seen at Union Bay, Vancouver Island, but, as the birds were very shy, specimens could not be secured.

Order RAPTORES.

Suborder FALCONES.

Family FALCONIDÆ.

Subfamily BUTEONINÆ.

MILVUS ATER MELANOTIS (Temminck and Schlegel).

SIBERIAN BLACK KITE.

This species was very common about all the Japanese towns we visited, but I did not notice it at the Oki Islands, Sado Island, nor Matsushima. It was particularly abundant at Hakodate, where I counted twenty-two sailing about together over some object of

mutual interest in a field. This bird in the Japanese harbors plays the part of scavenger, assisting the numerous gulls. It is very adept at picking bits of food up from the water, devouring it afterwards on the wing.

BUTEO BUTEO JAPONENSIS (Gmelin).

JAPANESE BUZZARD.

On Matsushima a *Buteo* was very common, which may have been this species.

AQUILA CHRYSÆTOS (Linnaeus).

GOLDEN EAGLE.

I observed this species once on Unalaska and several times on Atka, where it appears to be rather common.

THALASSAËTUS PELAGICUS (Pallas).

KAMCHATKAN SEA EAGLE.

On May 26 while collecting birds in the broad valley which makes up into the mountains in a southerly direction from the town of Unalaska, in company with Dr. F. E. McCullough, U. S. Navy, of the *Albatross*, I saw a bird of this species. It sailed across the valley almost directly above our heads and very low down. I happened to have a Winchester repeating rifle with me at the time. The bird offered an exceptionally easy shot, but unfortunately the rifle missed fire. On returning to the ship, Prof. J. O. Snyder, of Stanford University, California, told me of a peculiar eagle he had seen which I have no doubt was the same bird; he had met with it about a mile away from the place where I saw it. A thorough survey of these islands may show that this species, as well as *Haliaëtus albicilla*, which has been recently recorded from Unalaska, are of more or less regular occurrence throughout the whole group.

I subsequently met with this bird in Kamchatka where I saw several examples in the vicinity of Petropaulski, and in the island of Sakhalin, where I saw two near Korsakoff.

HALIAËTUS ALBICILLA BROOKSI (Hume).

EASTERN GRAY SEA EAGLE.

This bird was seen a few times in the vicinity of Petropaulski, and once near Korsakoff, Sakhalin.

Specimens of white-tailed sea eagles from eastern Asia, the Commander Islands, and Japan are small, and are apparently identical with specimens in the National Museum collection from northern India, belonging to the race which has been named *brooksi* by Hume. Probably Aleutian and northwestern American records should be referred to this form.

HALIAETUS LEUCOCEPHALUS ALASCANUS C. H. Townsend.**ALASKAN BALD EAGLE.**

Bald eagles were very common about Union Bay, Vancouver Island, and abundant at Unalaska. They were very common at Atka, where on a small island off the coast an Indian shot 175 last winter to prevent their making depredations on the young of a colony of blue foxes which had been established there. I did not see any of these eagles on Agattu, Attu, or the Commander Islands.

Family FALCONIDÆ.**FALCO PEREGRINUS ANATUM (Bonaparte).****DUCK HAWK.**

In my collection there is a typical young female of this subspecies, secured by Mr. F. M. Chamberlain off the Colombian coast, about 100 miles southwest of Panama, in November, 1903. It agrees with another specimen from Colombia in the National Museum collection, and with specimens from the United States.

FALCO PEREGRINUS PEALEI Ridgway.**PEALE'S FALCON. TSCHORNIJ JASTRIP. AGULEK.**

This species was observed on all the Aleutian Islands we visited, but did not appear to be abundant. It was noticed at Bering Island, and several were seen at Simushir in the Kurils. Peale's Falcon is strikingly different from the Peregrine in life, appearing at a little distance quite black. About the rocky and barren shores of the Aleutian and Kuril islands the actions of this bird are in every way similar to those of its representative *Falco peregrinus anatum* in its winter haunts along the shores of the West Indies.

Family PANDIONIDÆ.**PANDION HALIAETUS (Linnæus), subspecies.****OSPREY.**

Ospreys were common about Petropaulski at the time of my visit, but I did not notice them anywhere else.

The material available is insufficient for me to form an opinion as to the identity of the east Asiatic with the European or with the American bird; they appear, however, to be slightly nearer the latter.

PANDION HALIAETUS CAROLINENSIS (Gmelin).**AMERICAN OSPREY.**

The Fish Hawk was not uncommon about Union Bay, Vancouver Island, at the time of my visit.

Order STRIGES.

Family STRIGIDÆ.

ASIO FLAMMEUS (Pontoppidan).

SHORT-EARED OWL.

At Unalaska I saw Short-eared Owls frequently in the low grassy district near Dutch Harbor, but they were very shy, and I did not succeed in getting any specimens. I did not happen to see this bird at any other point during the entire cruise.

STRIX OCCIDENTALE CAURINUM (Merriam).

MERRIAM'S SPOTTED OWL.

This owl was not uncommon in the woods about Union Bay, Vancouver Island.

SURNIA ULULA DOLIATA (Pallas).

SIBERIAN HAWK OWL.

Some species of owl was very common about Petropaulski at the time of my visit. It occurred along the ridge of hills behind the town, wherever there were large trees. The birds were very noisy, and kept up a continual hooting all day long. Owing to the dense, and in some places almost impenetrable, undergrowth, I found it impossible to approach any of them, although several hours were wasted in the attempt. As this is the only owl known from this locality at this season, it seems probable that this was the form.

From certain remarks made by authors, it would seem as if the Hawk Owl of Kamchatka represented a good subspecies, distinguished by a greater development in the amount of white in the plumage; but a specimen from Petropaulski collected by Dr. W. H. Dall, in the National Museum, while rather light in general coloration, is easily matched by specimens of *S. u. doliata* from other parts of its range. The record of *Surnia ulula* from Alaska should be referred to this form, *Surnia ulula doliata* (Pallas).

Order COCCYGES.

Suborder CUCULI.

Family CUCULIDÆ.

Subfamily CUCULINÆ.

CUCULUS CANORUS TELEPHONUS (Heine).

EASTERN CUCKOO. KAKKOK.

The Eastern Cuckoo was abundant in the scrubby growth about Petropaulski, and its loud and clear "cuck-oo," which was heard all through the day from sunrise to sunset, was one of the characteristic bird notes of the locality.

Suborder **ALCYONES.**Family **ALCEDINIDÆ.****CERYLE ALCYON** (Linnaeus).**BELTED KINGFISHER.**

I found the Belted Kingfisher rather common about Dockton, Washington, and about Union Bay, Vancouver Island, at the time of my visit.

Order **PICI.**Family **PICIDÆ.****PICUS MARTIUS** (Linnaeus).**GREAT BLACK WOODPECKER. KUMAGERA.**

Dryocopus martius reichenowi KOTHE, Orn. Monatsb., June, 1906, p. 95.

I saw a single specimen of this handsome and striking species near the town of Korsakoff, Sakhalin.

Kothe has bestowed a subspecific name upon this bird in the eastern part of its range; but a specimen in the U. S. National Museum taken by Doctor Stejneger at Cape Patience, Sakhalin, agrees perfectly with examples from Europe. Mr. Buturlin, in a recent study of this species, has also come to the conclusion that there is no recognizable eastern form.

DRYOBATES VILLOSUS HARRISI (Audubon).**HARRIS' WOODPECKER.**

This woodpecker was rather common about Dockton, Washington, and Union Bay, Vancouver Island. Specimens secured are typical of the race.

DRYOBATES PUBESCENS GAIRDNERII (Audubon).**GAIRDNER'S WOODPECKER.**

Gairdner's Woodpecker was common about Dockton, Washington, principally in clearings in which were scattered dead trees.

COLAPTES AURATUS LUTEUS (Bangs).**NORTHERN FLICKER.**

The National Museum collection contains a Flicker which was captured on St. Georges Island, Pribiloff group, in the autumn of 1904 by James Judge. In a letter dated October 5, 1904, he mentions the bird as "recently shot." This appears to be the first record of this species for the Bering Sea islands.

COLAPTES CAFER SATURATION (Ridgway).**NORTHWESTERN FLICKER.**

The Northwestern Flicker was common at Dockton, Washington, and at Union Bay, Vancouver Island. A female secured at the latter locality is typical of the form.

YUNX TORQUILLA (Linnaeus).**WRYNECK. ARISU.**

A male Wryneck was captured on board the *Albatross* on October 2, when off the northeast coast of Yezo, near the southern Kurils. It is darker above and below than any of the specimens of this species in the National Museum collection, even darker than the specimen from Urakami, Kiusiu, mentioned by Doctor Stejneger.^a The measurements are: Wing, 79 mm.; tail, 65 mm.; culmen, 15 mm.; tarsus, 20 mm.; middle toe, 17 mm.

Order MACROCHIRES.**Suborder CYPSELLI.****Family MICROPODIDÆ.****Subfamily MICROPODINÆ.****MICROPUS PACIFICUS (Latham).****WHITE-RUMPED SWIFT.**

What appeared to be this species was very abundant about the rugged shores and summits of the more inaccessible rocky hills on Matsushima.

Suborder TROCHILI.**Family TROCHILIDÆ.****SELASPHORUS RUFUS (Gmelin).****RUFIOUS HUMMINGBIRD.**

This elegant little hummingbird was very common about Dockton, Washington, and about Union Bay, Vancouver Island.

Order PASSERES.**Suborder CLAMATORES.****Family TYRANNIDÆ.****MYIOCHANES RICHARDSONII (Swainson).****WESTERN WOOD PEEWEE.**

This species was found not uncommonly about Dockton at the time of our visit.

EMPIDONAX DIFFICILIS Baird.**WESTERN FLYCATCHER.**

Common about Dockton, Washington, and Union Bay, Vancouver Island. Other flycatchers were seen at these localities, but as no specimens were secured I can not be sure of their identity.

^a Proc. U. S. Nat. Mus., vol. 15, 1892, p. 296.

Suborder OSCINES.

Family ZOSTEROPIDÆ.

ZOSTEROPS STEJNEGERI (Seeböhm).

STEJNEGER'S WHITE-EYE.

I found a species of *Zosterops*, whether *Z. stejnegeri* or *Z. japonicus* I am unable to say, common on Matsushima in the Sea of Japan.

Family ALAUDIDÆ.

ALAUDA ARVENSIS BLAKISTONI Stejneger.

KAMCHATKAN SKYLARK.

The Kamchatkan Skylark was rather common in the meadows about Petropaulski where it was in full song, and I met with a few about the sand dunes near Nikolskoi, on Bering Island.

Family CORVIDÆ.

Subfamily GARRULINÆ.

PICA PICA KAMTSCHATICA Stejneger.

KAMCHATKAN MAGPIE. KAKUK.

This fine magpie was common about Petropaulski at the time of our visit, and was perhaps the most conspicuous bird. I found it in all situations, but most frequently on scrubby hillsides. It was very shy and difficult to approach.

CYANOCITTA STELLERI STELLERI (Gmelin).

STELLER'S JAY.

Steller's Jay was common in the woods about Dockton, Washington, and Union Bay, Vancouver Island.

Subfamily CORVINÆ.

CORVUS CORAX PRINCIPALIS Ridgway.

NORTHERN RAVEN.

The raven is the only corvine bird found in the Aleutian Islands, although the American Magpie occurs on the Alaska peninsula and on the Shumagins. On Unalaska and Atka I found these birds very common, and, about the towns, very bold. They frequented the sea front of the town of Unalaska, and several were seen about the houses of the town on Atka. Away from the villages, however, they were very shy, and I found it difficult to secure specimens. They were most abundant along the beaches and cliffs bordering the sea, but in these situations they were very shy, much more so than the eagles. I saw none on Agattu, nor did I find any traces of them, although they occur there; possibly their distribution on that island is local. On

Attu comparatively few were seen, not more than six or seven during the entire stay; but here again they may have deserted the district about the harbor for some of the streams where the salmon were running where they could be sure of a good supply of food.

CORVUS CORAX BEHRINGIANUS Dybowski.

COMMANDER ISLAND RAVEN. VORÓN.

I only saw this species once, on Copper Island, about the cliffs near the sea.

CORVUS CORAX KAMTSCHATICUS Dybowski.

KAMCHATKAN RAVEN.

This bird also I only met with once, on the summit of a hill on the farther side of the large pond near Petropaulski.

CORVUS BRACHYRHYNCHOS CAURINUS (Baird).

NORTHWEST CROW.

I saw a few of these crows at Dockton, Washington, and found them abundant at Union Bay, Vancouver Island. They were common along the beach in front of the town and about the houses, as well as in the woods along the shore. They were quite unsuspicious, and I had no trouble in securing specimens.

CORVUS CORONE ORIENTALIS (Eversmann).

EASTERN CARRION CROW.

The Eastern Carrion Crow was common along the coasts near Petropaulski. There were a number on the wooded peninsula which separates the harbor of Petropaulski from Avacha Bay, where I found several nests in the trees along the crest of the bluff on the outer side. My efforts to reach them were, however, unsuccessful.

On Simushir I found a pair of these birds about the cliffs at the right hand end of the sandy beach at Milne Bay.

The few crows observed on Matsushima were apparently of this species.

CORVUS MACRORHYNCHOS JAPONENSIS (Bonaparte).

JAPANESE RAVEN.

This crow was very common at Hakodate, about the town, especially in the park, as well as about the harbor. Individuals first boarded us long before we came to an anchorage, and, making the foreyard their headquarters, were quick to seize any opportunity for making off with pieces of meat or other provisions left unguarded. At Mororan they were also common, the first ones coming out to meet us when we were 2 miles or more from shore, and, as their visit had not been anticipated, their raid on the meat hung up in the

port gangway, was very successful. They were rather more bold here than at Hakodate, and frequented the hurricane deck, perching on the davits or the flagstaff at the stern watching for opportunities. They were quite fearless, but always managed to elude the vengeance of the cook or the men.

In the Oki Islands there was a large crow roost in the outskirts of the town, the birds being apparently of this species.

NUCIFRAGA CARYOCATACTES KAMCHATKENSIS Barroet-Hamilton.

KAMCHATKAN NUTCRACKER.

A few of these birds were seen on a hill near Petropaulski, in a grove of pines.

Family FRINGILLIDÆ.

PINICOLA ENUCLEATOR KAMTSCHATKENSIS (Dybowski).

KAMCHATKAN PINE GROSBREAK.

On June 17 I shot a male Pine Grosbeak on one of the hills behind Petropaulski. Although in immature plumage it was singing and the testicles were enlarged, indicating that probably it was a breeding bird. No others were seen.

This specimen, compared with a series of eight *P. e. enucleator* from Norway, Sweden, and north Russia, shows no difference in size. A male from Sweden, and also a male from Pomerania, match it exactly in every dimension. In color, however, it is a purer, clearer gray, the yellow on the head more golden and brighter.

PYRRHULA PYRRHULA KAMTSCHATICA (Taczanowski).

KAMCHATKAN BULLFINCH.

I saw a few of these bullfinches about Petropaulski, but did not succeed in getting any specimens.

CARPODACUS PURPUREUS CALIFORNICUS (Baird).

CALIFORNIA PURPLE FINCH.

This species was very common about the town at Union Bay, Vancouver Island, where specimens were secured. A nest was found on May 15 containing half-grown young. It was in a thick bush, about three feet from the ground.

CARPODACUS ERYTHRINUS GREBNITSKII Stejneger.

GREBNITSKII'S SCARLET ROSE FINCH.

These handsome birds were abundant about the scrubby hillsides near Petropaulski, their pretty whistling song being, except that of *Calliope calliope*, the most characteristic bird note of the locality. Red and gray males appeared to be about equally common, the gray birds equaling the red in vocal efforts. Two of the latter which were secured (both in song at the time) had the sexual organs developed, and appeared to be breeding birds.

LEUCOSTICTE TEPHROCOTIS GRISEONUCHA (Brandt).

ALEUTIAN LEUCOSTICTE. PETUSCHÓK.

The Aleutian Leucosticte was common on the Aleutian Islands we visited, and also on Copper and Bering islands. At Unalaska and Atka it was most frequent at moderate elevations, about patches of snow, only one or two being seen in the valleys. At Attu and on the Commander Islands I found it most commonly along the seacoast, especially about rocky beaches. At Attu I found a pair about some cliffs just behind a narrow beach, whose actions led me to suspect that they had a nest in the vicinity, but I was unable to find it. I did not find this species on Agattu.

Measurements of a series of 28 specimens from Unalaska, Atka, Adak, Kiska, Attu, and from Copper and Bering islands, show a tendency to an increase in size toward the west, which is correlated with a slight increase in intensity of coloration, the Unalaska birds averaging smaller and duller, and the Commander Island birds larger and brighter, the others being intermediate.

CHLORIS SINICA USSURIANUS Hartert.

USSURILAND GREENFINCH.

The Ussuriland Greenfinch was very common on Matsushima, in the Sea of Japan, where it frequented hillsides covered with scrubby bushes. In habits it appeared to be similar to the common Goldfinch (*Carduelis carduelis*).

PASSERINA NIVALIS TOWNSENDI Ridgway.

TOWNSEND'S SNOW BUNTING. SNIEGIBOK.

Townsend's Snowflake is a common bird on all the Aleutian and on the Commander islands. It is usually very wary, and specimens are hard to secure. At Unalaska I found the Snowflakes common only in the higher altitudes, where the ground was largely covered with snow. They were here extremely shy, and I only succeeded in getting four. At Atka also they were only found in the higher elevations where the ground was mainly snow covered, and I had great difficulty in obtaining specimens, more than in shooting ptarmigan. I did not find this species on Agattu; but I was unable to visit the more snowy districts of the island. On Attu and on the Commander Islands this bird was most common along the seacoast, especially about rocky beaches, where it was not at all difficult to get within range. At Attu, indeed, I saw none at all in the snowy districts.

As in the case of the other resident finches of the Aleutian Islands, birds from Unalaska average the smallest, the average size gradually increasing, reaching a maximum on the Commander Islands.

One of my males from Unalaska has the feathers of the rump tipped with rusty (May 27, 1906). Two of the females in my collection have considerable rusty on the rump, and all some on the scapulars. All the males have black bills. The females have dusky bills, except one from Attu, which has the mandible except the tip yellow.

On June 9, at Attu, I found a nest of this species, with four eggs. It was in a recess under a large boulder, about a foot from the opening, which was almost completely hidden by a large tuft of grass. It was situated on the beach to the right of the harbor entrance, not much above high-water mark. The male was flushed from the nest and secured.

CALCARIUS LAPPONICUS ALASCENSIS Ridgway.

ALASKAN LONGSPUR.

The Longspur is the most abundant bird throughout the Aleutian and Commander islands. Although occurring everywhere except in the highest altitudes, it is most common on the lower levels. Besides the Song Sparrow (*Melospiza*) this was the only small bird I found on Agattu.

Birds from the Aleutian Islands appear to average rather more brilliant in coloration than those from the mainland, the difference, however, being very slight. Aleutian specimens show a slight average tendency toward deeper colors toward the western part of the chain, not, however, approaching in richness of coloration *C. l. coloratus* of the Commander Islands.

Measurements of forty-seven specimens from the Aleutian and Commander islands show a tendency toward increased size at the western end of the chain and on the Commander Islands, the smallest birds coming from Unalaska, and the largest from Bering Island. The Commander Island birds, although bearing the same relation in size to birds from Attu and Agattu as birds from these islands do to others from Atka, are markedly different in color; and it is interesting to note that, while Commander Island birds are in size just what we should expect did *C. l. alascanus* occur there, the color is wholly different.

Aleutian specimens of *C. l. alascanus* are somewhat larger than continental birds.

CALCARIUS LAPPONICUS COLORATUS Ridgway.

COMMANDER ISLAND LONGSPUR. TSCHELUTSCHJEK.

This form is very common on the Commander Islands. Besides differing greatly in color, especially the females, from Aleutian birds, there is a decided difference in the notes; in addition to the regular song, which is the same as with *C. l. alascanus*, they have another consisting of three somewhat whistling notes, very clear and sweet.

Nineteen specimens from Copper and Bering islands show very little individual variation in color.

PASSERCULUS SANDWICHIENSIS SANDWICHIENSIS (Gmelin).**SANDWICH SPARROW.**

This species was abundant on Unalaska, in the grassy lowlands. I obtained fourteen specimens near Dutch Harbor. I did not find it on any of the other islands we visited. It was also common at Union Bay, Vancouver Island, in grassy places near the shore.

ZONOTRICHIA LEUCOPHRYS NUTTALLI Ridgway.**NUTTALL'S SPARROW.**

Nuttall's sparrow was very common in the clearings and more open places about Dockton, Washington. The birds were in full song at the time of our visit. Specimens secured are typical of this subspecies.

TISA VARIABILIS (Temminck).**GRAY BUNTING.**

Tisa variabilis A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 468.

This species was rather common about Petropaulski, but was very retiring; I only found it in dense alder thickets, where it was usually seen on or near the ground. Owing to the difficulty of penetrating these thickets without making considerable noise and startling all the inhabitants, I was only able to secure a single specimen, which I found, together with its mate, near a spring by the side of the large pond behind Petropaulski.

MELOSPIZA CINEREA MORPHNA Oberholser.**RUSTY SONG SPARROW.**

The Rusty Song Sparrow was very common about Dockton, Washington, occurring in all open places and clearings. It was also abundant about Union Bay, Vancouver Island. On May 13, at the latter locality, I secured a young bird with the tail feathers nearly the full length, and found several others, one of which was taken, just able to fly.

Specimens from both localities agree with others from Seattle, Washington, and Victoria, British Columbia, and are typical of the subspecies.

MELOSPIZA MELODIA SANAKA McGregor.**ALEUTIAN SONG SPARROW.**

I was not fortunate enough to find this form at Unalaska, although I searched carefully for it. At Atka it occurred, though not abundantly, in the rank grass along the beaches, and in the gorge of the small stream which flows through the town. At Agattu I found it in the tall grass along the shore about Macdonald Bay and along the marshy banks of the lower reaches of the stream which enters the sea at this point. At Attu it occurred in the grassy areas all along the

shore and about the town. This bird does not appear to be abundant anywhere, and seems to be strictly limited to the vicinity of the sea.

A series of 29 birds from Unalaska, Atka, Kiska, Adak, Agattu, and Attu show considerable individual and seasonal variation in the intensity of the gray in the plumage. Birds from the western end of the chain appear to average rather grayer than those from Unalaska. They are also a trifle larger.

In the National Museum collection there are 5 fully grown young from Unalaska, 3 shot on July 12, 1 on August 14, and 1 on August 15; 1 from Kiska, taken July 7; a young bird, just able to fly, from Attu, June 11, and another, nearly fully grown, from Attu, June 20.

PIPILO MACULATUS OREGONUS (Bell).

OREGON TOWHEE.

This bird was very common at Dockton, Washington, and at Union Bay, Vancouver Island, occurring mainly in the more open places.

Nine specimens, representing both localities, agree with Puget Sound specimens in the National Museum collection.

HYPOCENTOR AUREOLUS (Pallas).

YELLOW-BREASTED BUNTING. GOLDAMMER.

I found this bird very common about Petropaulski, especially in pastures with scattered trees and bushes and on scrubby hillsides. Their song, which is very sweet and pleasing, was heard on all sides, this bird ranking next after *Carpodacus erythrinus grebnitskii* and *Calliope calliope* as the third best vocalist of the district.

A critical examination of twenty-one males of this species (Petropaulski, 8; Bering Island, 3; Yezo, 2; Goto Islands, 1; Siberia, 2; north Russia, 1; Tungchou, China, 1, shot in the spring; and Yezo 2, and Canton 1, shot in the autumn and winter) shows that the Kamchatkan birds average the largest, being considerably larger than Japanese. The Siberian specimens agree in size with Japanese, and the example from northern Russia is rather larger. The winter birds from China and Japan are larger than breeding examples, indicating a northern origin. There is no color variation correlating with locality. While there is considerable individual variation, especially in regard to the dusky about the head and the extent of the black centers to the dorsal feathers and in the intensity of the maroon collar, I find that the two finest and most handsome specimens, which are practically alike in every way, come one from the Goto Islands and the other from Petropaulski. These specimens have the maroon collar mixed with dusky feathers and bordered anteriorly with black.

HYPOCENTOR RUSTICA (Pallas).

RUSTIC BUNTING.

This species was not rare about Petropaulski, although not as abundant as the preceding, frequenting the scrubby hillsides.

A series of twelve males from Petropaulski, Bering Island, Yezo, and Pekin, China, shows no appreciable difference in coloration correlated with locality. The Kamchatkan birds are the largest, the Japanese specimens intermediate, and the Chinese ones the smallest.

PASSER MONTANUS MONTANUS (Linnaeus).

TREE SPARROW.

Sparrows were very common about all the Japanese towns, the Tree Sparrow of Europe becoming the House Sparrow of the east. One can not help noticing many advantages in having this neat, quiet, and unobtrusive little bird about a town rather than its larger, noisier, and more obstreperous relative. On Matsushima also this species was common about the houses and in the cultivated fields.

A specimen from Hakodate, taken July 3, 1906, and two males from Fusan, taken on November 8, 1885, agree well with European examples in color, but, as in the case of all the eastern specimens in the museum, the beak is somewhat stouter. Although I have referred the eastern birds to true *Passer montanus montanus*, I am not certain that it would not be better to recognize them as *Passer montanus orientalis*.

Family HIRUNDINIDÆ.

HIRUNDO ERYTHROGASTER Boddaert.

BARN SWALLOW.

A few Barn Swallows were noticed about the village of Unalaska at the time of our visit.

HIRUNDO TYTLERI Jordan.

BROWN-BELLIED SWALLOW.

This species was seen at Petropaulski at the time of our visit. They were not numerous, and none were obtained.

HIRUNDO RUSTICA GUTTURALIS (Scopoli).

EASTERN CHIMNEY SWALLOW.

This swallow was common about the Japanese towns, especially at Hakodate, where it was frequently seen to enter houses. I also found it common on Matsushima.

Family VIREONIDÆ.

VIREO GILVUS SWAINSONII (Baird).

WESTERN WARBLING VIREO.

The Western Warbling Vireo was fairly common about Dockton, Washington, but I only met with one or two at Union Bay.

Family MNIOTILTIDÆ.

HELMINTHOPHILA CELATA LUTESCENS Ridgway.

LUTESCENT WARBLER.

This warbler was rather common in the thickets about Dockton, Washington, and Union Bay, Vancouver Island. A pair from the latter locality are very dusky; but this is probably accounted for by the fact that they were secured near the wharf where steamers are coaled and the plumage had become infiltrated with fine coal dust.

DENDROICA ÆSTIVA RUBIGINOSA (Pallas).

PALLAS' WARBLER.

The Yellow Warbler was the commonest of the warblers at Dockton and Union Bay, occurring about all the more open places and clearings in the woods.

DENDROICA AUDUBONI (Townsend).

AUDUBON'S WARBLER.

Audubon's Warbler was common both at Dockton and Union Bay, occurring mainly in the fir trees.

DENDROICA NIGRESCENS (Townsend).

BLACK-THROATED GRAY WARBLER.

The Black-throated Gray Warbler was common both at Dockton and Union Bay, occurring about clearings in the woods. Specimens obtained are typical.

Other species of this genus were seen about Dockton and Union Bay, but no specimens were obtained.

GEOTHYLPIS TOLMIEI (Townsend).

MACGILLIVRAY'S WARBLER.

This species was common in the more open places about Dockton and Union Bay, Vancouver Island.

Family MOTACILLIDÆ.

MOTACILLA LUGENS Kuhl.

BLACK-BACKED KAMCHATKAN WAGTAIL.

This bird was common about Petropaulski, frequenting the seashore, especially about rocky beaches. I also found it at Simushir in the Kurils, where I am certain it was breeding.

MOTACILLA, species.

WHITE WAGTAIL.

A White Wagtail; apparently a migrant, was the commonest small bird observed at Sakhalin, occurring abundantly about the beaches and about the piers and jetties of Korsakoff. Two which were observed at close range appeared to be *M. lugens*, but, as none were secured, their identity is uncertain.

BUDYTES FLAVUS SIMILLIMUS Hartert.

KAMCHATKAN YELLOW WAGTAIL.

This bird was common in the lowlands about Petropaulski, especially in a broad valley which makes inland from the large pond near the town. Five males were secured here. Two examples from Plover Bay, Siberia, are difficult to place; they appear to be intermediate, one being somewhat nearer *B. f. alascanus* and the other nearer the present form.

ANTHUS GUSTAVI Swinhoe.

SCHLEGEL'S TITLARK. INKATSCHUGI.

This Pipit was common near the town on Copper Island and on the grassy lowlands of Bering Island. It was plentiful also in the lowlands about Petropaulski.

ANTHUS RUBESCENS (Tunstall).

AMERICAN PIPIT.

The American Pipit was found in the higher elevations on Unalaska, just below the snow line, but was not very common. A female secured had eggs nearly ready to lay. I did not meet with it anywhere else.

ANTHUS JAPONICUS Swinhoe.

JAPANESE ALPINE PIPIT.

I found this bird common in the grassy lowlands near Milne Bay, Simushir, but very shy and hard to get. The males were in full song at the time of our visit, June 23. Specimens secured agree with others from Japan.

PIPASTES MACULATUS (Jerdon).

EASTERN TREE PIPIT.

This bird was common about Petropaulski, more especially about the taller birch trees on the hills, from the top of which it would send forth its loud, clear, cheerful song, much after the manner of *Seirus aurocapillus*.

Family TROGLODYTIDÆ.

NANNUS HIEMALIS PACIFICUS (Baird).**WESTERN WINTER WREN.**

The Western Winter Wren was common about Dockton and Union Bay. There was at least one other species of wren at these places, but as I did not obtain specimens I can not be sure of the identity.

NANNUS MELIGERUS (Oberholser).**ATTU WREN.**

I found this wren common about the cliffs and rocky shores of Attu Island and in the gorge of the stream which enters the sea to the right of the town. I was not fortunate enough to find any other wrens in the Aleutian Islands.

NANNUS PALLESCENS (Ridgway).**COMMANDER ISLAND WREN. LIMASCHINKA.**

At Copper Island one or two of these wrens were seen about the cliffs near the town, but they did not seem to be common. I did not find them on Bering Island.

Family CERTHIDÆ.

CERTHIA FAMILIARIS OCCIDENTALIS Ridgway.**WESTERN BROWN CREEPER.**

This bird was not uncommon in the woods about Dockton, Washington, and Union Bay, Vancouver Island.

Family PARIDÆ.

PENTHESTES RUFESCENS RUFESCENS Townsend.**CHESTNUT-BACKED CHICKADEE.**

The Chestnut-backed Chickadee was common about Dockton and Union Bay, usually in small flocks. Specimens secured are typical of the race.

PENTHESTES KAMTSCHATICA (Bonaparte).**KAMCHATKAN CHICKADEE.**

A small company of these pretty little titmice was seen on one of the hillsides near Petropaulski.

PERIPARUS ATER INSULARIS Hellmayr.**JAPANESE COAL-TIT.**

A male of this form was caught on shipboard off Iwanai, on the east coast of Hondo, September 19, 1906. It is identical with others from Japan in the National Museum collection.

PSALTRIPARUS MINIMUS SATURATUS Ridgway.**NORTHWESTERN BUSH-TIT.**

This bird was common in the bushes about Dockton, Washington. Specimens brought back are typical of this subspecies.

ACANTHOPNEUSTE BORREALIS XANTHODRYAS (Swinhoe).**ARCTIC WILLOW WARBLER.**

A typical example of this subspecies, a female, was caught on board the *Albatross* in the Okhotsk Sea, about 7 miles west of Kunashir, Kurils, on October 1, 1906.

ACROCEPHALUS JAPONICUS (Cassin).**JAPANESE REED WARBLER.**

When I visited Simushir, in the Kurils, on June 23, 1906, I found this species abundant in the tall rank grass just back of the beach and about the piles of driftwood. It was by far the commonest bird on the island. The only other small birds I saw near Milne Bay were *Anthus japonicus*, which was rather common on the grassy lowlands behind the fringe of rank beach grass, and *Motacilla lugens*, which was not very common and only seen along the rocky seacoast.

The seven specimens secured agree with others in the National Museum collection from the other Kurils and Japan.

ACROCEPHALUS OCHOTENSIS (Middendorf).**MIDDENDORF'S GRASSHOPPER WARBLER.**

When we were off the eastern coast of Sakhalin, and for the first half of the journey across the Okhotsk Sea, many birds of this genus, resembling those I had found on Simushir, but paler and more olive in color, came on board. I have tentatively referred them to *A. ochotensis*, although I can not be positive of the identification, as none were secured.

HYLOCICHLA GUTTATA GUTTATA (Pallas).**HERMIT THRUSH.**

The Hermit Thrush was occasionally seen in the woods near Dockton and about Union Bay, but did not appear to be common.

PLANESTICUS MIGRATORIUS PROPINQUUS Ridgway.**WESTERN ROBIN.**

The Western Robin was not uncommon about the more extensive clearings in the vicinity of Dockton and Union Bay and in the outskirts of those two towns. Puget Sound specimens are deeper in color than birds from more southern localities, especially on the breast, and I believe that eventually it will be found advisable to recognize them as a distinct race.

PETROPHILA MANILLA (Boddaert).**BLUE AND RED ROCK THRUSH. ISO HIO-DORI.**

This bird was not uncommon on Matsushima, in the Sea of Japan.

CALLIOPE CALLIOPE (Pallas).**RUBY-THROATED NIGHTINGALE. KAMCHATKAN NIGHTINGALE.**

The "Kamchatkan Nightingale" was the most abundant bird about Petropaulski and also the best songster. Its fine, clear song was the most characteristic bird note of the place, and was heard from sunrise to sunset. This species shows a preference for hillsides covered with scrubby growth, in which it is very adept at concealing itself. It is also common on the lowlands where any little clumps of bushes occur sufficient to afford it shelter. Most of its time is spent on or near the ground, but the song is usually delivered from the tops of the bushes or the lower limbs of small trees. If surprised in such a situation, the bird is very quick to take refuge in the thick underbrush.

At Simushir I found two or three pairs of this species among the driftwood well beyond high-water mark. They were rather shy and kept well under cover. From their actions I judged that they were breeding here.

A careful examination of twenty males of this species shows that breeding birds from Kamchatka are appreciably larger than those from Yezo in all dimensions. The birds appear to fall into two classes in regard to size; a larger, measuring, wing 78-83 (80.5) mm.; tail, 61-67 (64) mm.; tarsus, 29-32 (30.5) mm., which is the size of the Kamchatkan birds; and a smaller, measuring, wing 72-76 (74) mm.; tail, 58-60 (59) mm.; tarsus, 27-30 (28.5) mm., which is the size of breeding birds from Yezo.

Of autumn and winter birds belonging to the first class, the National Museum possesses specimens from the following localities: Hakodate, Yezo (2); at sea off Kinkesan Light, Hondo; Yaeyama Island; Amoy, China; Malate, Philippines; and of the second class from Tung Chow, China (2); Malate, Philippines; and Nepal.

I can find no constant difference in color between birds from different localities not apparently the result of individual variation, but my material is unsatisfactory in this respect.

During the first two weeks of October, when we were about the southern Kurils and the eastern coast of Yezo and Hondo, these birds were frequent visitors to the ship. One was captured on October 10, several miles east of Kinkesan Light, on the coast of Hondo.

DESCRIPTION OF A NEW SPECIES OF DEEP-WATER SCULPIN (*TRIGLOPSIS ONTARIENSIS*) FROM LAKE ONTARIO, WITH NOTES ON RELATED SPECIES.

By DAVID STARR JORDAN and WILLIAM FRANCIS THOMPSON,
Of Stanford University, California.

In the work of the International Fisheries Commission on Lake Ontario, Dr. Seth Eugene Meek, acting as assistant to the commission, secured a fine specimen of a species of sculpin from deep water off Toronto.

This specimen belongs to the genus *Triglopsis* of Girard, the freshwater representative of the marine genus *Oncocottus*, and it is presumably descended from species of the latter genus left in the Great Lakes on their elevation from the sea.

This specimen, which is in very perfect condition, may be described as follows:

TRIGLOPSIS ONTARIENSIS Jordan and Thompson; new species.

One specimen, No. 64599 U.S.N.M., 128 mm. long, taken in deep water off Toronto by Dr. Seth Eugene Meek.

Head $3\frac{1}{2}$ in length to base of caudal; depth $4\frac{1}{2}$; width at base of pectorals 4; orbit 5 in head; interorbital space $5\frac{1}{2}$; depth of caudal peduncle equal to interorbital space, its length 2 in head; height of first dorsal twice in width of body at pectorals, of second dorsal twice that of first; dorsal rays IX-15; anal 14; pectoral 16.

Body broad, head depressed, cylindrical from pectorals to caudal peduncle, which is slightly compressed. Head long, broad; snout moderate, $3\frac{1}{2}$ in head; gape wide; interorbital space broad, concave; maxillaries extending to below posterior margin of eyes; eyes large; gill membranes attached to isthmus very narrowly, almost forming a fold across; a short slit behind fourth gill; a short spine above each orbit, one on each side of median line at occiput; four blunt ones on preoperculum, of which the dorsal and largest points upward and backward, the ventral downward, the others pointing backward and downward; none curved or hooked; one on operculum at lower angle,

much smaller than others; three on each side at junction of operculum edge and body, attached to shoulder girdle and posterior bones of head, all rather small, curved posteriorly, and hooked; a similar one on upper angle of operculum; dorsal surface of head slightly roughened by small papillæ; body smooth, without scales or bristles.

Lateral line following line of dorsal, well above axis of body, chain-like, reaching center of caudal peduncle, well developed throughout.

First dorsal much lower than second, the latter being twice the former when longest rays are measured to tip; base of first longer than height; base of second equal to its height and to body width at pectorals; rays of second produced into filaments two-fifths of total length, last six bifurcated; anal similar to second dorsal in insertion

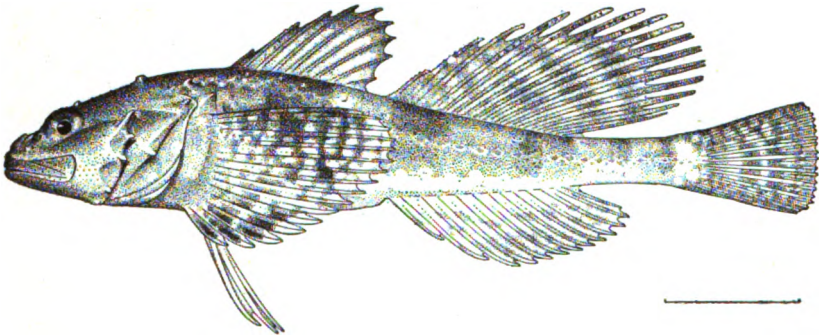


FIG. 1.—*TRIGLOPSIS ONTARIENSIS* JORDAN AND THOMPSON.

and length, but rays much less produced as filaments; pectorals very broad at base, long, their insertion less oblique than in *Triglopsis thompsoni*, tip extending considerably beyond insertion of second dorsal and vent, which is beneath last of first dorsal; ventrals long, reaching to anus, but not as long as pectorals. Vent slightly nearer caudal base than tip of snout.

Color in spirits a darker yellowish ground with mottled dark above, forming 4 or 5 indistinct stripes across body; below colorless; dorsal, pectoral, and caudal fins with indistinct cross bands on light background, tips clear, ventrals and anals clear save for light stippling on anal.

The skeleton of the head is very soft and cavernous

Comparative measurements of *T. ontariensis*, "*T. stimpsoni*," and *T. thompsoni*.

	Ontariensis.	"Stimpsoni."	Thompsoni. (after Olard).
Locality.....	Lake Ontario off Toronto.	Lake Michigan off Chicago.	Lake Ontario off Oswego.
♂ Length without caudal.....mm.	128	59	88
Depth of body.....hundredths.	0.21	0.165	0.165
Width at pectorals.....do.	.26	.155	.....
Head.....do.	.27	.33	.33
Distance from vent to snout.....do.	.55	.50	.50
Depth of caudal peduncle.....do.	.06	.045	.05
Length of same from anal to caudal rays.....do.	.16	.13	.13
Dorsal rays.....no.	IX-15	VIII-14	VII-18
Anal rays.....no.	14	14	15
Pectoral rays.....no.	16	18	18
Branchiostegals.....no.	6	6	6
Length of snout.....hundredths.	0.09	0.10	0.12
Diameter of orbit (bone to bone).....do.	.065	.09	.085
Maxillary length from tip of snout.....do.	.13	.15	.15
Interorbital width.....do.	.06	.03	.....
Pectoral length (longest ray).....do.	.32	.25	.22
Pectoral base (width).....do.	.14	.11	.....
First dorsal height (longest ray).....do.	.13	.11	.09
Second dorsal height (longest ray).....do.	.27	.15	.27
Dorsal bases.....do.	0.19 + .26	0.16 + .28	.....
Anal height.....do.	.15	.11	.....
Anal base.....do.	.27	.29	.30
Ventral length.....do.	.24	.13	.14

♂ All measurements are in hundredth of body length to base of caudal.

We have compared with this specimen an example from deep water off Chicago (No. 629 Stanford University) collected by Dr. Stephen A. Forbes. To this Lake Michigan species, the name of *Triglopsis stimpsoni* was given by Doctor Hoy in 1872^a from a specimen collected by himself.

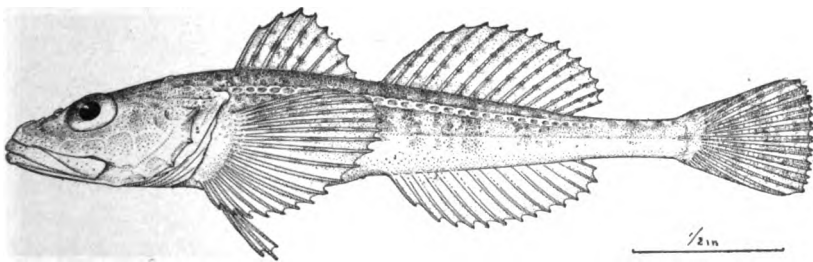


FIG. 2.—*TRIGLOPSIS STIMPSONI* HOY.

This specimen agrees with the description and figures of *Triglopsis thompsoni* from Lake Ontario in all respects except the following:

Lateral line distinct to last rays of second dorsal. Dorsal rays VIII-14; anal rays 14, ending opposite second dorsal. The soft dorsal is not very much higher than spinous dorsal. In *Triglopsis thompsoni*, the soft dorsal is three times as high as the first, the dorsal rays are VII-18, and the anal rays 15, the lateral line is distinct to

^a Trans. Wis. Acad. Sci., 1872, p. 98.

eighth soft ray of dorsal. In *T. ontariensis*, which has a much deeper and thicker body, the second dorsal is twice as high as the first, which is also unusually high. The lateral line is distinct to the base of caudal, and the mouth is much smaller than in *T. thompsoni* or *T. stimpsoni*, the snout being also shorter.

We present a figure of the specimen from Lake Michigan, typical of the nominal species, *Trigloopsis stimpsoni*. We are unable, without more material, to determine whether *Trigloopsis stimpsoni* is a valid species or not. The lower dorsals and the smaller number of fin rays constitute the chief apparent differences. This figure, as also the figure of *Trigloopsis ontariensis*, is drawn by Mr. W. S. Atkinson.

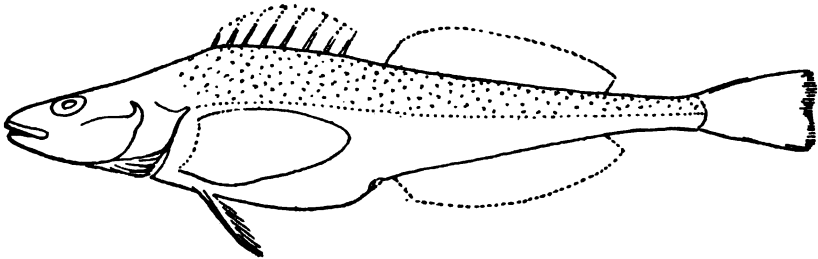


FIG. 3.—*COTTUS RICEI* (NELSON) FROM THE ORIGINAL TYPE.

Among the remains of *Trigloopsis thompsoni* from stomachs of the predatory ling (*Lota maculosa*), off Oswego, examined by Doctor Girard, are also fragments of another little-known deep-water sculpin, *Cottus ricei* (Nelson). Of this species, which has never been figured, we present an outline made from Nelson's original type many years ago.

REPORT ON ISOPODS FROM PERU, COLLECTED BY DR. R. E. COKER.

By HARRIET RICHARDSON,

Collaborator, Division of Marine Invertebrates, U. S. National Museum.

In a collection of isopods sent by Dr. Robert E. Coker to the U. S. National Museum are three species, two of which are new to science. The third species, *Meinertia gaudichaudii* (Milne Edwards), has previously been recorded from Peruvian shores by Schiødtte and Meinert^a in 1883. At an earlier date, 1877, Miers,^b in a paper entitled On a collection of Crustacea, chiefly from South America, described a species of *Anilocra* from Peru, and also recorded *Cymothoa æstrum* as probably occurring there. These are the only marine isopods so far recorded from Peru.

MEINERTIA GAUDICHAUDII (Milne Edwards).

Cymothoa gaudichaudii MILNE EDWARDS, Hist. Nat. Crust., vol. 3, 1840, p. 271.

Ceratothoa rapax HELLER, Reise Novara, Crust., 1865, p. 146, fig. 17.

Ceratothoa gaudichaudii SCHIØDTTE and MEINERT, Nat. Tidsskr. (3), vol. 13, 1883, p. 335, pl. 13, figs. 11-15.

Meinertia gaudichaudii STEBBING, Hist. Crust., 1893, p. 345.—RICHARDSON, Proc. U. S. Nat. Mus., vol. 21, 1899, p. 829; Ann. Mag. Nat. Hist. (7), vol. 4, 1899, p. 171; Proc. Wash. Acad. Sci., vol. 3, 1901, p. 568.—STEBBING, Willey's Zool. Results, 1902, p. 643.

Locality.—Mollendo, Peru. From the mouth of a large "Jurel."

Distribution.—From Mazatlan, Mexico, to Chile; Galapagos Islands. Also recorded from the Louisiade Archipelago, New Guinea.

Description.—Body elongate, nearly three times as long as broad, 16 mm.: 45 mm.

Head nearly twice as wide as long, 4 mm.: 7 mm., somewhat triangular in shape, with apex obtuse. The head is deeply set in the first thoracic segment, the narrow and acute antero-lateral angles of which extend half the length of the head. Eyes small, distinct, irregular in outline, but inclined to be square, and placed at the sides of the head, a little below the middle.

^a Nat. Tidsskr. (3), vol. 13, 1883, p. 335, pl. 13, figs. 11-15.

^b Proc. Zool. Soc. London, 1877, p. 671.

The first antennæ are composed of seven articles, the two first ones being almost fused; they extend just below the eye. The second antennæ are composed of nine articles and extend to the posterior margin of the head. The basal articles of the first pair of antennæ are

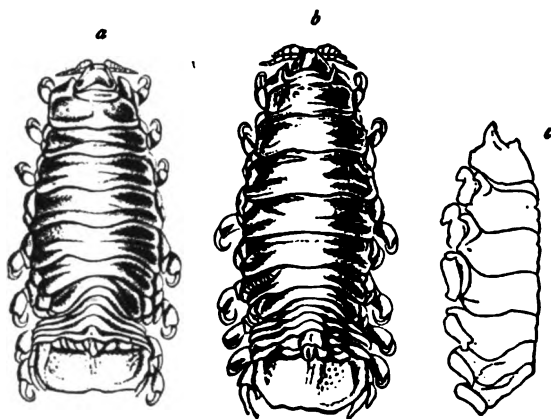


FIG. 1.—*MEINERTIA GAUDICHAUDII* (AFTER SCHIGEDTE AND MEINERT). a, ADULT FEMALE. b, ADULT FEMALE. c, LATERAL VIEW OF THORAX. (ENLARGED.)

adjacent on the ventral side. The articles of both pairs of antennæ are greatly dilated and flattened. The maxillipeds have a palp of two articles. The palp of the mandibles is composed of three articles, the terminal one being very slender and minute. The second maxillæ terminate in two lobes furnished with small hooks.

The first segment of the thorax is longer than any of the others, being 6 mm. in length; the second and fifth segments are subequal, each being 4 mm. long; the third and fourth are each 5 mm. in length; the sixth segment is 3 mm. long; the seventh is 2 mm. long. The antero-lateral angles of the first segment are narrow and acute and are produced forward to about the middle of the head. The epimera are distinctly separated on all the six following segments. They are narrow, elongated plates, not extending quite to the posterior margin of the segments.

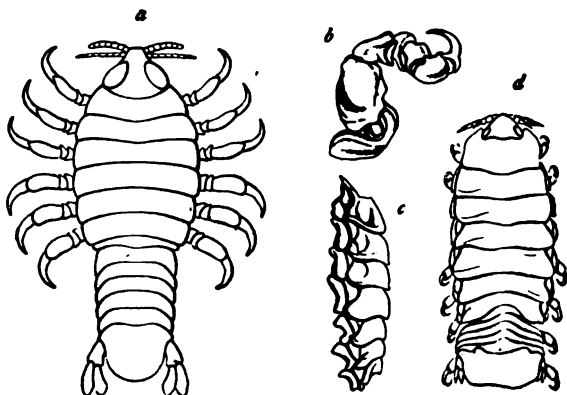


FIG. 2.—*MEINERTIA GAUDICHAUDII* (AFTER SCHIGEDTE AND MEINERT). a, YOUNG OF FIRST STAGE. b, SECOND LEG OF ADULT MALE. c, LATERAL VIEW OF THORAX OF ADULT MALE. d, ADULT MALE. (ENLARGED.)

The abdomen is deeply set in the thorax. The first segment has the sides covered by the last thoracic segment. The four following segments are as wide as the seventh thoracic segment or wider. The sixth or terminal segment is trapezoidal, almost twice as wide as

long, 7 mm. by 13 mm. The post-lateral angles are rounded and the posterior margin straight. The uropoda are a little longer than the terminal abdominal segment. The inner branch is slightly longer than the outer branch. Both are narrow, elongate, and produced to acute and tapering extremities.

The legs are all prehensile, and terminate in short, stout dactyli. There is a high carina on the basis of the last four pairs of legs, the carina increasing in height from the fourth to the seventh pair, where it is extremely high.^a

SPHÆROMA PERUVIANUM, new species.

Body oblong-ovate, covered with small granules, which on the abdomen become much more numerous and larger, more like tubercles.

Head large, wider than long, with the front produced in a small median point. Two small tubercles are situated close to the anterior margin, one on either side of the median line. The eyes are placed in the post-lateral angles and are large and composite. The first antennæ have the first article twice as long as wide; the second article is half as long as the first; the third is slender and is about as long as the first two taken together; the flagellum is composed of eleven articles and extends to the middle of the lateral margin of the first thoracic segment. The second antennæ, with a flagellum of nineteen articles, extend to the posterior margin of the second thoracic segment. The first maxilla has the inner lobe furnished with four plumose processes, the outer lobe with thirteen spines, eight long and five short ones. The mandible has the apical tooth trifid.



FIG. 3.—SPHÆROMA PERUVIANUM.
× 54. (Drawn by Miss V. Dandridge.)

The segments of the thorax, with the exception of the first, have a transverse tuberculated ridge. The seventh segment is furnished with four large tubercles in a transverse line, two on either side of the median line. The lateral parts of all the segments are produced in narrow triangular lobes, with rounded extremities.

The first segment of the abdomen has two large tubercles, one on either side of the median line, and two smaller ones on either side of these, making six in a transverse row. The terminal segment is broadly rounded posteriorly, with the apex slightly truncate. On the anterior portion are six prominent tubercles, four in a transverse

^a For description of the male, female, and young of the first stage, see Schiedte and Meinert, Nat. Tidsskr. (3), vol. 13, 1883, p. 335.

line, two on either side of the median line and two below this transverse row, one on either side of the median line. Close to the lateral margin on either side, and just below the middle of the segment, there is a thick bunch of hairs. The inner branch of the uropoda is pointed at the extremity and extends but little beyond the abdomen. The outer

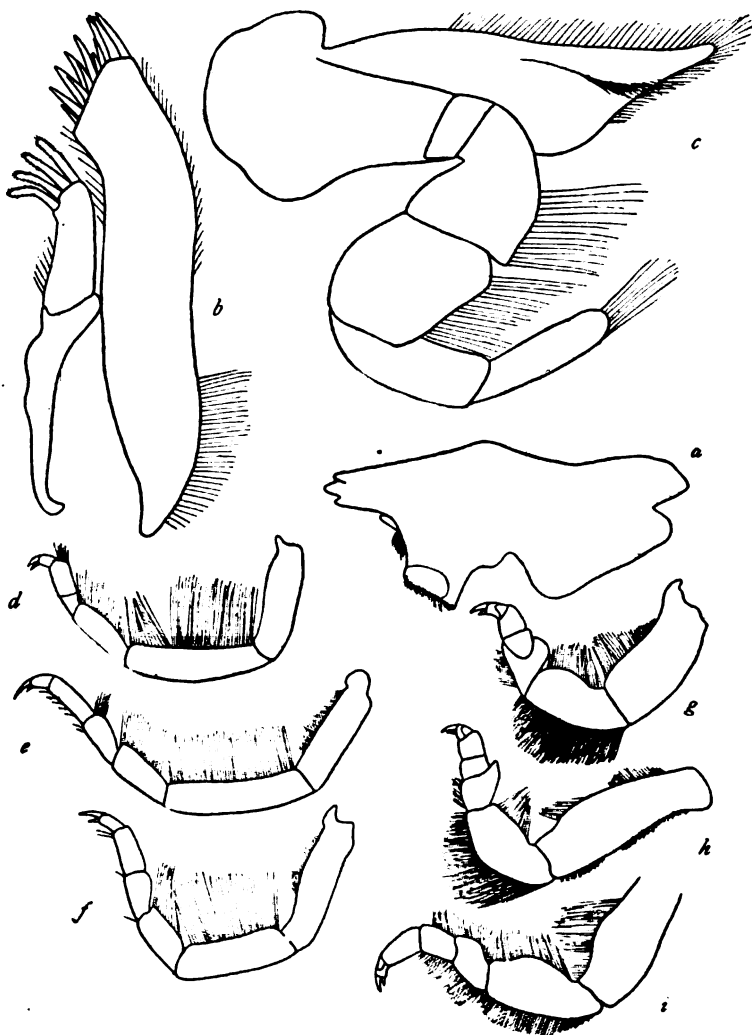


FIG. 4. —*SPHÆROMA PERUVIANUM*. *a*, MANDIBLE. $\times 23$. *b*, FIRST MAXILLA. $\times 41$. *c*, MAXILLIPED. $\times 41$. *d*, FIRST LEG. *e*, SECOND LEG. *f*, THIRD LEG. *g*, FOURTH LEG. *h*, FIFTH LEG. *i*, SIXTH LEG. $\times 14\frac{1}{2}$.

branch has two teeth on the outer margin, with only a feeble indication of a third. This branch is about as long as the inner branch and is also pointed at the extremity. The first three pairs of legs are long and slender, the last four short and stout. All are covered with long hairs.

A large number of specimens were collected in the oyster beds of Matapalo (near Capon), Peru. They were found in wood, in holes bored by them. The wood was completely honeycombed.

The following notes were supplied by Doctor Coker: "These small crustacea are economically significant, since they enter the green stems and roots of the mangroves, causing the wood to decay. The falling away of these destroyed branches and roots causes the loss of the many oysters attached to them. As I rarely observed the *Teredo* in the green stems, it seems that these crustacea are the most pernicious form and undoubtedly they prepare the way for the more rapidly destructive *Teredo*. (A nest of young included.) 'Piojos de Mangle' (Mangrove louse). Fishermen attribute to these the destruction of oysters that is really accomplished by the drill."

This species differs from the other wood-boring forms of this genus in the smaller number of teeth on the outer branch of the uropoda, in the shape of the terminal segment, in the difference in the arrangement of the tubercles, in the presence of a bunch of hairs on either side of the terminal segment, in the trifold apical tooth of the mandibles, in having four plumose processes on the inner lobe of the first maxillæ and thirteen on the outer lobe, and in the difference in the shape of the maxillipeds.

Type-specimen.—Cat. No. 40333, U.S.N.M.

ORBIMORPHUS, new genus.

Body of adult female, ovate.

Head large, with a narrow frontal border.

Lateral bosses present on the first four segments of the thorax. Lateral to these are the epimera, which extend the entire length of the lateral margin. Epimera are present on all the segments of the thorax and on the first four segments of the abdomen, but are not greatly developed. There are four pairs of double-branched pleopods, and a pair of double-branched uropoda.

The male has all the segments of the thorax distinct. Those of the abdomen are fused, but at the base of the abdominal segment is a notch on either side indicating a fused first segment. There are no uropods or pleopods.

Type of the genus.—*Orbimorphus constrictus*, new species.

This genus is very close to *Orbione* Bonnier but differs in having the pleural lamellæ or epimera of the thorax and abdomen of the female not so enormously developed. The male^a also differs in having the first segment of the abdomen indicated by a notch on either side of the terminal segment.

^a The male of *Orbione* Bonnier has not been described or figured, but I hope soon to give a figure of this form from a specimen of *O. peni* collected recently by the Bureau of Fisheries steamer *Albatross*.

ORBIMORPHUS CONSTRICTUS, new species.

Body of adult female ovate, somewhat irregular in outline.

Head large, and with a narrow frontal border. Eyes absent. First pair of antennæ small, composed of three articles, the terminal one being minute. Second pair of antennæ concealed by the mouth parts.

The seven segments of the thorax are distinct. Lateral bosses are present on the first four. Lateral to these are the epimeral plates, which extend the entire length of the lateral margin, and which are

larger on one side of the body than on the other. The epimera of the last three segments are also well developed.

The abdomen is composed of five segments, the fifth or terminal segment being small and not provided with pleural plates as are the first four segments. The segments of the abdomen are rather indistinctly defined in the middle of the dorsal region. There are four pairs of double-branched pleopods, the lamellæ being leaf-like. The uropods are a pair of double-branched oval lamellæ, a little shorter than the branches of the pleopods, all of which encircle the abdomen, and project beyond the pleural plates of the abdominal segments. There

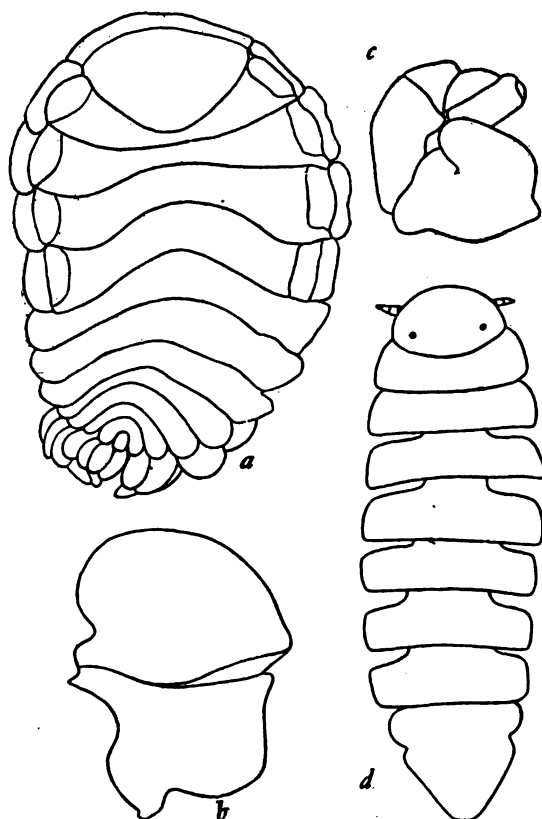


FIG. 5.—ORBIMORPHUS CONSTRICTUS. *a*, ADULT FEMALE. $\times 14\frac{1}{2}$. *b*, FIRST LAMELLA OF MARSUPIUM. $\times 23$. *c*, SEVENTH LEG OF FEMALE. $\times 41$. *d*, MALE. $\times 41$.

are seven pairs of prehensile legs, all furnished with a high rounded carina on the basis. There are five pairs of incubatory plates, the first pair having the distal half produced in a small lobe.

The male is narrowly elongate. The head is large, transversely oval. Eyes are small and distinct. All seven segments of the thorax are distinctly defined, with lateral margins not contiguous, but separated by a small indentation. The segments of the abdomen are all united to form a single tapering segment, with posterior extremity

rounded. Near the base on either side is a small notch probably indicating the first fused segment. There are no pleopods or uropods.

One male and one female were collected at Matapalo (near Capon), Peru. They were taken from the branchial cavity of *Petrolisthes armatus* (Gibbes) which was found in oyster beds.

Type-specimen.—Cat. No. 40133, U.S.N.M.

ADDITIONAL ISOPODS KNOWN FROM PERU.

ANILOCRA LÆVIS Miers.

Anilocra lævis MIERS, Proc. Zool. Soc. London, 1877, p. 672, pl. 68, fig. 6.

Localities.—Martinique; Peru.

CYMOTHOA ŒSTRUM (Linnaeus).

(?) *Oniscus œstrum* LINNÆUS, Syst. Nat., 12th ed., 1766, p. 1059.—FABRICIUS, Syst. Ent., 1775, p. 294.

Cymothoa œstrum FABRICIUS, Syst. Ent., vol. 2, 1793, p. 505.—LEACH, Trans. Linn. Soc., vol. 11, 1815, p. 372.—DESMAREST, Cons. Gén. Crust., 1825, p. 309, pl. 47, figs. 6, 7.—MILNE EDWARDS, Hist. Nat. Crust., vol. 3, 1840, p. 269; Règne Anim. Cuvier (éd. Crochard), Crust., pl. 45, fig. 1.—SPENCE BATE and WESTWOOD, Hist. Brit. Sessile-eyed Crust., 1868, vol. 2, p. 274, footnote.—MIERS, Proc. Zool. Soc. London, 1877, p. 671.—SCHIEDTE and MEINERT, Nat. Tidsskr. (3), vol. 14, 1883, p. 271, pl. 8, figs. 5-6.

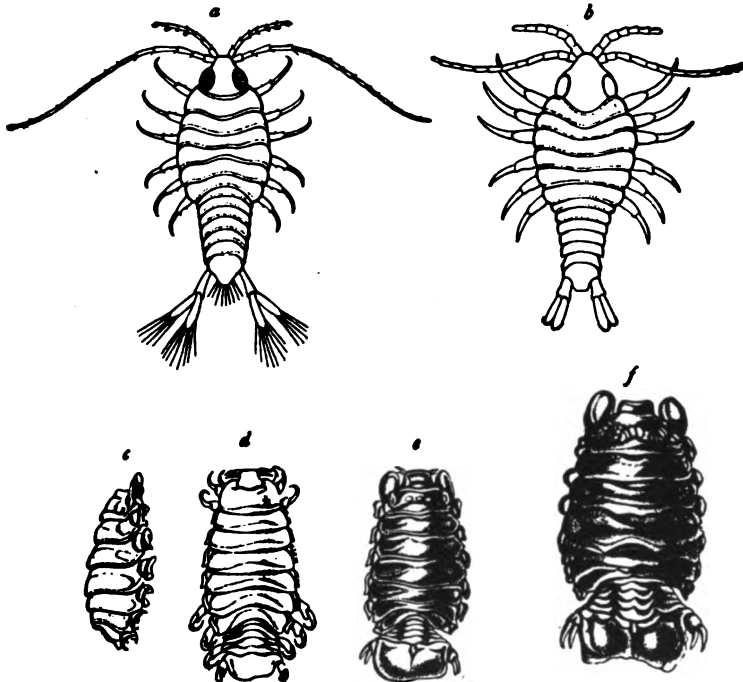


FIG. 6.—*CYMOTHOA ŒSTRUM* (AFTER SCHIEDTE AND MEINERT). a, YOUNG OF THE SECOND STAGE (ENLARGED). b, YOUNG OF THE FIRST STAGE (ENLARGED). c, LATERAL VIEW OF THORAX OF ADULT FEMALE (REDUCED). d, ADULT MALE (ENLARGED). e, ADULT FEMALE (REDUCED). f, ADULT FEMALE (REDUCED).

Localities.—Virginia, southward throughout the Gulf of Mexico and Caribbean Sea; Peru (according to Miers). Parasitic on fish.

THREE NEW GENERA AND SPECIES OF PARASITIC HYMENOPTERA.

By J. C. CRAWFORD,

Assistant Curator, Division of Insects, U. S. National Museum.

Two of the genera described in this paper were received in the regular course of work through the Department of Agriculture, and the other was first found in the material donated to the U. S. National Museum by the Washington Biologists' Field Club. Of the genera described, two are very interesting on account of their hosts, and the one first described is the most interesting, belonging as it does to a family no member of which has hitherto been reported as an egg parasite. In the study of these species, as in all other work on the Chalcidoidea, a Zeiss binocular microscope, with a magnification of from 28 to 35, has been used.

Superfamily CHALCIDOIDEA.

Family MISCOGASTERIDÆ.

ERIXESTUS, new genus.

Head slightly wider than thorax; clypeus medially deeply incised; mandibles with four long teeth; antennæ 12-jointed, with two ring joints, inserted on the middle of the face, very similar in the two sexes; funicular joints almost quadrate, slightly pedicellate at base; club of antennæ slightly enlarged in the female, in the male not thicker than the joints of the funicle; parapsidal furrows complete; scutellum at base with an arcuate fovea and with a cross furrow before apex; axillæ almost meeting; hind tibiæ with two apical spurs, one very small; abdomen with a short petiole; wings with marginal fringes, the postmarginal vein about as long as the marginal, the stigmal shorter.

In Doctor Ashmead's classification of the Chalcidoidea this genus would run to the Miscogasterini, where it does not seem closely related to any known genus.

Type of genus.—*E. winnemana* Crawford.

ERIXESTUS WINNEMANA, new species.

Female.—Length 1 mm. Above deep purple, the parapsidal areas, the abdomen, face and cheeks greenish-blue; antennæ brown, scape and pedicel testaceous; face smooth, polished, vertex back of ocelli finely roughened; median area of mesonotum finely transversely lineolate, parapsidal areas, axillæ and postscutellum before cross furrow indistinctly reticulate; back of cross furrow smooth; metathorax smooth, medially with a transverse carina, back of this a median longitudinal carina which at apex of metathorax divides and runs laterally; legs testaceous; abdomen smooth, polished.



FIG. 1.—*ERIXESTUS WINNEMANA*, ADULT FEMALE.

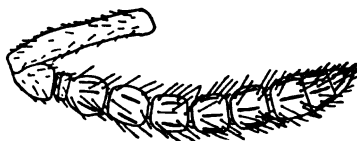


FIG. 2.—*ERIXESTUS WINNEMANA*, ANTENNA OF FEMALE.

Male.—Length 1 mm. Similar to the female, the antennæ more hairy.

Type-locality.—Plummer's Island, Maryland.

Ten specimens bred from the eggs of *Calligrapha bigsbyana*, collected by Mr. E. A. Schwarz; also twelve paratypes bred from the eggs of *Calligrapha scalaris* collected by Mr. Frederick Knab on the Virginia shore of the Potomac River opposite Plummer's Island.

Type.—Cat. No. 12916, U.S.N.M.

The specific name is an Indian name applied to the island and means "beautiful island."

The insect so completely fills the parasitized egg that it seems impossible for it to be anything but a primary parasite.

Family ENCARTIDÆ.

Subfamily ENCARTINÆ.

Tribe MIRINI.

PSYLLEDONTUS, new genus.

Head not thin antero-posteriorly; not distinctly lenticular; lateral ocelli away from the margins of the eyes; the eyes pubescent; antennæ inserted close to the mouth, the funicle 5-jointed, no ring joint apparent, the antennæ similar in both sexes; axillæ contiguous; marginal vein punctiform; post-marginal not developed; marginal fringes of wings short; mesonotum strongly metallic; abdomen above flat, not strongly pubescent.

This genus differs from the genus *Rhopus* by being metallic, by having the antennæ similar in both sexes, the head robust, and by the short marginal fringes of anterior wings. The genus *Metallon* is described as having rudimentary wings and the axillæ slightly separated.

Type of genus.—*P. insidiosus* Crawford.

PSYLLEDONTUS INSIDIOSUS, new species.

Female and male.—Length 1 mm. Head and thorax somewhat purple; the scutellum bright bluish-green; eyes large, distance between them greatly less than length of scape; face well produced below the eyes; face above finely reticulate; mesonotum finely



FIG. 3.—*PSYLLEDONTUS INSIDIOSUS*, ADULT FEMALE.

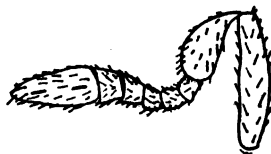


FIG. 4.—*PSYLLEDONTUS INSIDIOSUS*, ANTENNA OF FEMALE.

reticulate; the scutellum elongate, triangular, finely longitudinally rugulose; wings hyaline, strongly iridescent; legs black, femora at bases and apices, tips of tibiæ, and tarsi almost entirely, light yellowish.

Type-locality.—Geneva, New York. Bred from nymphs of the pear psylla.

P. J. Parrott, collector.

Type.—Cat. No. 12782, U.S.N.M.

PLAGIOMERUS, new genus.

Metallic; antennæ 9-jointed, the funicle 4-jointed, the first two joints transverse, pedicel elongate, much longer than joints one and two of funicle together, no ring joint apparent; labrum not prominent; eyes strongly convergent above; antennæ inserted below the level of the eyes; vertex without thimble-like punctures, ornamented with two bristles; axillæ meeting along the median line; scutellum at apex with a cluster of flattened scales; wings hyaline; marginal vein not punctiform, as long as the stigmal, postmarginal distinct; abdomen flattened above, sheaths of ovipositor subexserted.

Homalopoda Howard has the vertex with thimble-like punctures; the wings dusky with hyaline spots; the pedicel hardly longer than wide, the first two joints of the funicle subquadrate, as long as the pedicel, the last two slightly longer.

Cercobelus Walker is said to have the abdomen elongate compressed; the pedicel elongate, the first joint of the funicle longer than wide.

Type of genus.—*Plagiomerus diaspidis* Crawford.

PLAGIOMERUS DIASPIDIS, new species.

Female.—Length about 1 mm. Metallic colored, the head greenish or bluish, the mesonotum bronzy black, the metathorax and base of abdomen greenish or bluish, the rest of abdomen deep bronzy; face almost smooth, the vertex finely roughened; antennæ light yellowish, base of scape and pedicel dark, basal joints of funicle and the club slightly dusky; mesonotum finely reticulate; scutellum with very fine thimble-like punctures; postscutellum and metathorax smooth; wings strongly iridescent; legs dark, the tarsi whitish; knees and apices of tibiæ of

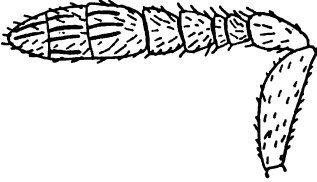


FIG. 5.—*PLAGIOMERUS DIASPIDIS*, ANTENNA OF FEMALE.

front legs, basal half and apices of femora, bases and apical half of the tibiæ of middle legs, knees, bases and apices of tibiæ of hind legs, light colored; abdomen smooth.

Male.—Unknown.

Type-locality.—New Mexico.

Host.—*Diaspis cacti*.

Type.—Cat. No. 12917, U.S.N.M.

THE BATRACHIANS AND REPTILES OF FORMOSA.

By LEONHARD STEJNEGER,

Curator, Division of Reptiles and Batrachians, U. S. National Museum.

When Robert Swinhoe, in 1863, published the first List of the Formosan Reptiles he had only 15 species to enumerate. After the lapse of forty-four years the species of reptiles known to occur in Formosa and its outlying islands had increased to 50, as given in my Herpetology of Japan.^a To-day, three years after the issue of the latter, the number has risen to 66. The record of the batrachians is still more remarkable. Swinhoe collected only 4 species of batrachians in Formosa, as follows: *Hyla chinensis*, *Microhyla fissipes*, *Rana plancyi*, and *Rana tigerina*. In 1907 I recorded 9 species. In the present paper there are enumerated 20 species.

The activity in collecting these animals in Formosa since the publication in 1907 of the Herpetology of Japan has raised the total number of batrachians and reptiles known to occur in that island from 59 to 86 species. Of the 26 species thus added to the fauna, no less than 15 are new species, and 8 represent genera hitherto not known to occur on the island.

These additions are recorded in seven papers by five authors, as follows:

- 1908. BARBOUR, THOMAS. Some new Reptiles and Amphibians. Bull. Mus. Comp. Zool., vol. 51, no. 12, pp. 315-325.
- 1909. BARBOUR, THOMAS. Notes on Amphibia and Reptilia from Eastern Asia. Proc. New England Zool. Club, vol. 4, Nov. 24, 1909, pp. 53-78, pls. 6-7.
- 1908. BOULENGER, G. A. Descriptions of a new Frog and a new Snake from Formosa. Ann. Mag. Nat. Hist. (8), vol. 2, Aug. 1908, pp. 221-222.
- 1909. BOULENGER, G. A. Descriptions of four new Frogs and a new Snake discovered by Mr. H. Sauter in Formosa. Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1909, pp. 492-495.
- 1909. DENBURGH, JOHN VAN. New and previously unrecorded Species of Reptiles and Amphibians from the Island of Formosa. Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, pp. 49-56.
- 1908. NAMIYE, M. Poisonous Serpent of Formosa. Zool. Mag. Tokyo, no. 236, June 15, 1908, pp. 192-194, pl. —.
- 1910. SIEBENROCK, L. Clemmys mutica Cant. von der Insel Formosa. Ann. Naturh. Hofmus. Wien, vol. 23, pp. 312-317, pls. 12-13.

^a Bulletin 58, U. S. National Museum.

Of the 86 species enumerated below 7 are truly marine snakes and turtles, and therefore have no bearing on the problems of the geographical distribution of the other species.

Of the remaining 79 species no less than 24 species are peculiar to the island, as follows:

AMPHIBIA.

- | | |
|----------------------------------|------------------------------------|
| 1. <i>Bufo bankorensis</i> . | 6. <i>Rana sauteri</i> . |
| 2. <i>Microhyla fissipes</i> . | 7. <i>Rana taipehensis</i> . |
| 3. <i>Microhyla steinegeri</i> . | 8. <i>Rana adenopleura</i> . |
| 4. <i>Rana longicrus</i> . | 9. <i>Polypedates moltrechti</i> . |
| 5. <i>Rana swinhoana</i> . | 10. <i>Polypedates robustus</i> . |

REPTILIA.

- | | |
|------------------------------------|----------------------------------------|
| 11. <i>Japahura swinhonis</i> . | 18. <i>Xenodon stejnegeri</i> . |
| 12. <i>Japahura mitsukurii</i> . | 19. <i>Macropisthodon carinatus</i> . |
| 13. <i>Takydromus formosanus</i> . | 20. <i>Achalinus formosanus</i> . |
| 14. <i>Takydromus sauteri</i> . | 21. <i>Oligodon ornatus</i> . |
| 15. <i>Takydromus kuenei</i> . | 22. <i>Dinodon ruhrstrati</i> . |
| 16. <i>Natrix swinhonis</i> . | 23. <i>Boiga krazepelini</i> . |
| 17. <i>Natrix sauteri</i> . | 24. <i>Amblycephalus formosensis</i> . |

Thus 50 per cent of the batrachians of the island are peculiar, but only about 26 per cent of the reptiles.

Both of these figures are high, and it is quite possible that a few of the species now listed as peculiar may be discovered later in some part of southern China. It is also possible that a slight reduction may eventually have to be made in the genera *Rana* and *Takydromus*, but this loss is just as likely to be offset by future separation of island forms now thought to be identical with the mainland species.

Of the 10 peculiar batrachians the relationship of 2 is somewhat dubious, namely, *Microhyla steinegeri* and *Rana taipehensis*. Two have their nearest relations known in the Riu Kius and Japan, namely, *Polypedates moltrechti* and *P. robustus*. Two more are nearly related to Chinese species, namely, *Microhyla fissipes* and *Rana longicrus*, while the remaining 4 have distinct leanings toward species at home in the eastern Himalayas and the high country immediately to the east, Burma, Yunnan, etc.

Of the 14 peculiar reptiles the 3 species (?) of *Takydromus* are closely related to Chinese forms,^a while all the others are more or less intimately related to species occurring in the western provinces, on the upper Yangtse River, Upper Burma, Assam, or the eastern Himalayas. Two of the snakes, *Oligodon ornatus* and *Boiga krazepelini*, do not appear to have any near relations in China at all. It is not intended, however, to lay stress on the absence of these species in China or in

^a Which in their turn are related to a Himalayan species.

the more eastern provinces of that empire, as it is quite likely that these gaps may be filled when the mountain districts of southeastern China shall become better known, but rather to emphasize the strong connection between the Formosan species and those inhabiting the eastern Himalayas and the high land to the east.

This relationship is not only manifested by the peculiar species, but by the rest of the reptilian fauna as well. Leaving out the geckos and skinks, the geographical distribution of which is subject to so many accidental circumstances, we have 35 species of land reptiles left, which also occur outside of Formosa. Of these 3 are of very wide distribution, extending into the Malayan Archipelago, but not occurring in the Himalayas or the high land to the east. These are, therefore, species of decidedly southern affinities. Seven species which occur in southern China, some of them extending southward into Indo-China and Siam, may be included in this category. Ten species are of more or less general distribution in eastern China. Finally, 15 species, one of which is doubtful, occur in the eastern Himalayas or the high land to the east or both.

On the other hand, none of the Formosan batrachians occurring outside the island are found in the Himalayas or the high land to the east. Of the 10 species 4 are wide-ranging and southern, 2 likewise southern but of more restricted distribution, 1 is strictly eastern Chinese, while 3 are also found in the Riu Kiu Islands, 1 of undoubted southern affinity, the other 2 probably likewise.

It will thus be seen that all the batrachians which have Himalo-Chinese affinities have differentiated into more or less distinct species, while those of southern affinities have remained nearly unchanged. It is also evident that the reptiles of southern affinities have remained practically unaltered in the island and that the specific differentiation almost exclusively took place among the Himalo-Chinese species; but the amount of differentiation in the reptiles was not nearly as large, for while it affected all the batrachians, it affected only 44 per cent of the reptiles. Whatever may be the reason for the greater amount of batrachian differentiation, the fact that practically no southern forms have undergone speciation in the island seems to indicate most plainly that the Himalo-Chinese component of the herpetological fauna of Formosa has lived much longer in the island than the more southern element, which must be a later arrival.

In this review of the relationship of the Formosan herpetological fauna the most striking fact, next to the prevalence of the Himalo-Chinese element, is the total absence of any indication of affinity to the fauna of the Philippine Islands directly to the south. A number of wide-ranging species of southern origin occur in both faunas, but as these also occur in southern China, on the mainland opposite For-

mosa, their way of dispersal is clearly indicated. There are only two species of this category which have not yet been collected in Chinese territory, namely, *Dasia smaragdina*, of wide distribution and which may owe its occurrence in Formosa to introduction by human agency, the other being a snake, *Psammophis pulverulentus*, the discovery of which within the limits of China would not cause surprise, as its known distribution includes Sikkim, Assam, and the Shan states. There seems, therefore, to be good reason for asserting that there has been no direct land connection between Formosa and the Philippine Islands since Formosa received its batrachian and reptilian fauna.

The present review is somewhat in the nature of a supplement to my Herpetology of Japan, hence a full synonymy of genera and species is only given in case of those which have been added since its publication in 1907, while in the other cases the page references to that work are given immediately below the specific name.

Class AMPHIBIA.

Order SALIENTIA.

Family BUFONIDÆ.

BUFO MELANOSTICTUS Schneider.

(Herpet. Japan, 1907, p. 72.)

Common. Recorded from Taipa, Giilan, and Taiwan fu.

BUFO BANKORENSIS Barbour.

1908. *Bufo bankorensis* BARBOUR, Bull. Mus. Comp. Zool., vol. 51, no. 12, p. 323 (type-locality, Bankoro, Central Formosa; type, No. 2432, Mus. Comp. Zool.; Owston collection); Proc. New England Zool. Club, vol. 4, 1909, p. 55, pl. 6.

Resembling *Bufo melanostictus*, but lacking the bony cranial crests. Exceedingly small tympanum. Also related to *Bufo himalayannus*.

Family HYLIDÆ.

HYLA CHINENSIS Guenther.

(Herpet. Japan, 1907, p. 86, pl. 9, fig. 4.)

In addition to the specimens there enumerated from Formosa, I have since examined a specimen belonging to Mr. Barbour (Owston collection) from the same island. It had no spots in the groin; teeth behind the choanæ.

Family ENGYSTOMIDÆ.

MICROHYLA FISSIPES Boulenger.

(Herpet. Japan, 1907, p. 88.)

1884. *Microhyla fissipes* BOULENGER, Ann. Mag. Nat. Hist. (5), vol. 13, p. 397; (8), vol. 4, Dec. 1909, p. 495.

In addition to those previously listed, Boulenger records specimens from Kosempo and Kanshirei.

MICROHYLA STEJNEGERI Boulenger.

1909. *Microhyla stejnegeri* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1, 1909, p. 494 (type-locality, Kanshirei, Formosa; types in Brit. Mus.; H. Sauter, collector).

Thus far only known from the specimens collected by Mr. Sauter at the village of Kanshirei.

Family RANIDÆ.

RANA PLANCYI Lataste.

(Herpet. Japan, 1907, p. 101.)

"The specimens recorded from Formosa are all in British Museum, the only ones with a definite locality being from Taiwan fu."

RANA LONGICRUS Stejneger.

(Herpet. Japan, 1907, p. 104.)

Only the type-specimen, from Taipa, is thus far known.

RANA LIMNOCHARIS Wiegmann.

(Herpet. Japan, 1907, p. 127.)

It is the commonest species of frog in Formosa, and is also recorded by me from the Pescadores and Botel Tobago.

RANA SWINHOANA Boulenger.

(Herpet. Japan, 1907, p. 132.)

1903. *Rana swinhoana* BOULENGER, Ann. Mag. Nat. Hist. (7), vol. 12, Nov. 1903, p. 556; (8), vol. 4, Dec. 1909, p. 495.

In addition to the types from Bangkimptsing, specimens have since been recorded from Kosempo.

RANA LATOUCHII Boulenger.

1899. *Rana latouchii* BOULENGER, Proc. Zool. Soc. London, 1899, p. 187, pl. 21, fig. 1 (type-locality, Kuatun, Fokien, China; types in Brit. Mus.; J. D'La Touche, collector); Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1, 1909, p. 495 (Fuhosho, Formosa).—DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 55 (Kanshirei, Formosa).

Originally described from the province of Fokien, China, this frog has been found in Formosa since the publication of the Herpetology of Japan, and recorded almost simultaneously by Boulenger and Van Denburgh.

RANA NAMIYEI Stejneger.

(Herpet. Japan, 1907, p. 36.)

1901. *Rana namiyei* STEJNEGER, Proc. Biol. Soc. Washington, vol. 14, Dec. 12, 1901, p. 190.—DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 55 (Kanshirei and Polisia, Formosa).

1909. *Rana kuhlii* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1, 1909, p. 495 (Fuhosho, Kanshirei, and Alikang, Formosa), (not of Duméril and Bibron ?).

Originally described by me from Okinawashima, Riu Kiu. The Formosan specimens are recorded by Boulenger as *Rana kuhlii* and by Van Denburgh as *R. namiyei*, the former expressing the belief that they should be united. Direct comparison between authentic specimens from Riu Kiu and from Formosa is required to decide which of the two forms occurs in the latter island.

RANA TIGERINA Daudin.

(Herpet. Japan, 1907, p. 139.)

Apparently common in Formosa.

RANA SAUTERI Boulenger.

1909. *Rana sauteri* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1, 1909, p. 493 (type-locality, Kanshirei village, 2,000 feet alt., Formosa; types in Brit. Mus.; H. Sauter, collector).

This addition to the Formosan fauna is said to be related to *Rana mortenseni*, from Burma and Siam.

RANA ADENOPLEURA Boulenger.

1909. *Rana adenopleura* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1, 1909, p. 492 (type-locality, Fuhacho village, 4,000 feet alt., Formosa; types in Brit. Mus.; H. Sauter, collector).

Another novelty, stated to agree very closely with *Rana pleuraden*, from Yunnan.

RANA TAIPEHENSIS Denburgh.

1909. *Rana taipehensis* DENBURGH, Proc. California Acad. Sci. (4), Dec. 20, 1909, p. 56 (type-locality, Taipei, Formosa; type, California Acad. Sci. No. 18007).

This is possibly the same as the foregoing species, though a comparison of the original descriptions shows several discrepancies.

Thus in *R. adenopleura* the vomerine teeth are described as "between the choanæ," in *R. taipehensis* as "between and extending behind the choanæ;" first finger as "extending slightly beyond

second," against "first not longer than second." In the coloration the most notable discrepancy is in the markings on the limbs, which in *R. adenopleura* are said to be marked "with dark cross bars," but in *R. taipehensis* "with longitudinal dark stripes." Boulenger compares his species with *R. pleuraden*, Van Denburgh his with *R. erythræa*.

POLYPEDATES MOLTRECHTI (Boulenger).

1908. *Rhacophorus moltrechti* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 2, Aug. 1908, p. 221 (type-locality, Lake Candidje, Nauto district, central Formosa; types in Brit. Mus.; Dr. A. Moltrecht, collector); vol. 4, Dec. 1909, p. 495 (Kosempo, Formosa).

Not as yet reported from outside Formosa.

POLYPEDATES ROBUSTUS (Boulenger).

1909. *Rhacophorus robustus* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1909, p. 494 (type-localities, Kankau, Alikang, and Kosempo, Formosa; H. Sauter, collector).

According to Boulenger this form is closely allied to *P. buergeri* of Japan (Herpet. Japan, 1907, p. 150).

POLYPEDATES EIFFINGERI (Boettger).

(Herpet. Japan, 1907, p. 153.)

1895. *Rana eiffingeri* BOETTGER, Zool. Anz., vol. 18, July 8, 1895, p. 267.—*Rhacophorus eiffingeri* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1909, p. 495 (Kanshirei, Formosa).

The recording of this form in Formosa by Boulenger is very interesting, since, like *P. robustus*, it is also related to *P. buergeri*, of which species it has been regarded as the Riu Kiu representative. It is consequently the more to be regretted that the exact locality of the type of *P. eiffingeri* is not known. The question also arises whether any form corresponding to *P. robustus* may not occur in the Riu Kiu Archipelago. As another possibility it is suggested that Hallowell may have been correct in recording *P. burgeri* from the "Loo Choo Islands," and from "Ousima."

POLYPEDATES JAPONICUS (Hallowell).

(Herpet. Japan, 1907, p. 155.)

1860. *Ixalus japonicus* HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1860, p. 501.—*Rhacophorus japonicus* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1909, p. 495 (Kankau, Formosa).

This is another Riukiuan species, now for the first time recorded from Formosa. As I have already shown in the Herpetology of Japan, it does not occur in Japan proper, notwithstanding the specific name given it by Hallowell.

Class REPTILIA.

Order SQUAMATA.

Suborder SAURIA.

Family GEKKONIDÆ.

GEKKO JAPONICUS (Duméril and Bibron).

(Herpet. Japan, 1907, p. 165.)

This species has its center of distribution in south-central and eastern China, and is said to be common everywhere in Formosa. The account of its habits by Swinhoe and reprinted in the Herpetology of Japan, pp. 164-165, refers particularly to Formosan specimens.

HEMIDACTYLUS FRENATUS Duméril and Bibron.

(Herpet. Japan, 1907, p. 172.)

Specimens from Taiwan fu are in British Museum and are in the Bergen Museum from "Formosa."

HEMIDACTYLUS BOWRINGII (Gray).

(Herpet. Japan, 1907, p. 176.)

1845. *Doryura bowringii* GRAY, Cat. Liz. Brit. Mus., p. 156.—*Hemidactylus bowringii* BARBOUR, Proc. New England Zool. Club, vol. 4, Nov. 24, 1909, p. 62 (Formosa).

In addition to the specimen recorded by me, Mr. Barbour has obtained two specimens from "Formosa."

COSYMBOTUS PLATYURUS (Schneider).

(Herpet. Japan, 1907, p. 178.)

No record additional to the one given there.

PEROPUS MUTILATUS (Wiegmann).

(Herpet. Japan, 1907, p. 180.)

The same remark applies to the present species.

Family AGAMIDÆ.

JAPALURA SWINHONIS Guenther.

(Herpet. Japan, 1907, p. 184.)

1864. *Japalura swinhonis* GUENTHER, Rep. Brit. India, p. 133, pl. 14, fig. B.—BARBOUR, Proc. New England Zool. Club, vol. 4, Nov. 24, 1909, p. 63 (Bankoro, Central Formosa).

Common throughout the island.

JAPALURA MITSUKURII Stejneger.

(Herpet. Japan, 1907, p. 190.)

Apparently restricted to the island of Botel Tobago.

Family SCINCIDÆ.

EUMECES ELEGANS Boulenger.

(Herpet. Japan, 1907, p. 202.)

Known both from Formosa and the Pescadores.

EUMECES CHINENSIS (Gray).

(Herpet. Japan, 1907, p. 208.)

Collected by Swinhoe at Tamsui and by Tada at Taipa.

MABUYA LONGICAUDATA (Hallowell).

(Herpet. Japan, 1907, p. 214, pl. 16.)

Nothing new has been added to our knowledge of the status of the Formosan specimens. Barbour, however, has examined specimens from Hainan and Siam and find that in these the scales have three keels, while Fischer's figure (reproduced in Herpet. Japan, pl. 16, fig. 5) shows only two, and on the strength of this discrepancy he suspects *Mabuya ruhstrati* (Fischer) from South Formosa of being a valid species.^a

SPHENOMORPHUS INDICUS (Gray).

(Herpet. Japan, 1907, p. 216, pl. 17, figs. 1-2.)

1853. *Hinulia indica* GRAY, Ann. Mag. Nat. Hist. (2), vol. 12, Dec. 1853, p. 388.—
Sphenomorphus indicus BARBOUR, Proc. New England Zool. Club, vol. 4,
Nov. 24, 1909, p. 64 (Bankoro, Central Formosa).

Two additional specimens, collected April 26, 1907, at Bankoro, Central Formosa, have been recorded by Mr. Barbour, to whose kindness I owe the privilege of examining them. Both have 34 scale rows around the middle of the body. The larger specimen is without a dark lateral band, which is quite pronounced in the smaller one.

Genus **DASIA** Gray.

1839. *Dasia* GRAY, Ann. Nat. Hist., vol. 2, no. 11, Jan. 1839, p. 331 (type, *D. olivacea*).
1843. *Liotropis* FITZINGER, Syst. Rep. p. 22 (type, *Euprepes ernesti*=*D. olivacea*).
1843. *Lamprolepis* FITZINGER, Syst. Rep., p. 22 (type, *Lygosoma smaragdinum*).
1845. *Keneuxia* GRAY, Cat. Liz. Brit. Mus., p. 79 (type, *K. smaragdina*).
1864. *Apterygodon* EDELING, Nederland. Tijdschr. Dierk., vol. 2, (p. 201), (type, *A. vittatum*).

The genus being additional to the fauna of Formosa and not included in the Herpetology of Japan, the synonymy, as well as that of the following species, is here given in full.

^a Proc. New England Zool. Club, vol. 4, Nov. 24, 1909, p. 64.

DASIA SMARAGDINA (Lesson).

1830. *Scincus smaragdinus* LESSON, Voy. Coquille, Zool., vol. 3, pt. 1, p. 43, pl. 3, fig. 1 (type-locality, Ualan, Caroline Islands; Lesson, collector).—*Lygosoma smaragdinum* BOULENGER, Cat. Liz. Brit. Mus., vol. 3, 1887, p. 250.—BARBOUR, Proc. New England Zool. Club, vol. 4, Nov. 24, 1909, p. 65 (Bankoro, Formosa).
1830. *Scincus viridipunctus* LESSON, Voy. Coquille, Zool., vol. 3, pt. 1, p. 44, pl. 4, fig. 1 (type-locality, Ualan, Caroline Islands; Lesson, collector).
1830. *Scincus caelestinus* GUÉRIN, Icon. Règne Anim., Rept., pl. 15, fig. 2 (type-locality not given, probably Java).
1872. *Lygosoma (Hinulia) smaragdinum* var. *viridifuscum* PETERS, Mon.-Ber. Berlin Akad. Wiss., 1872, p. 776 (type-locality, Boston Island; types in Berlin Mus.; Godeffroy collection).
1894. *Lygosoma acutirostre* OUDEMANS, in Semon, Zool. Forsch., vol. 5, (p. 141, fig.), (type-locality, Salayer Island, s. of Celebes).

A single, very young specimen was acquired by Mr. Barbour from Mr. Owston, whose collector obtained it in the central portion of Formosa. By a careful comparison I can find no character which would separate it from Philippine specimens.

Description.—Mus. Comp. Zool.; Bankoro, Central Formosa; April 26, 1907; Owston coll. No. 9255. Distance between the end of snout and the fore leg equaling the distance between axilla and groin; snout long, pointed, depressed; lower eyelid scaly; rostral large, broadly in contact with fronto-nasal; fronto-nasal large, pentagonal, broader than long, in contact with anterior loreal and prefrontals; prefrontals broadly in contact separating fronto-nasal from frontal; frontal as long as fronto-parietals and interparietal together, narrow behind, in contact with first, second, and third supraoculars; four subequal supraoculars; nine superciliaries, first two largest; fronto-parietals and interparietal distinct, the latter as long as suture between the former; parietals broadly in contact behind interparietal; four nuchals on left side, three on right; nostril in the middle of a single nasal; no supranasal; two loreals, one behind the other, both longer than high, especially the anterior, which is of the same height as the nasal; eight supralabials, sixth forming a large subocular much larger than the others and as long as the two anterior to it; two large temporals, the lower wedge-shaped, the upper longer, with parallel upper and lower edges and in contact with parietal; ear-opening small, with one upper larger and two small lower lobes on its anterior border; 26 rows of smooth scales around the middle of the body; preanal scales somewhat larger than those adjoining, especially the middle pair; hind leg stretched forward reaches the axil; subdigital lamellæ under fourth toe 33; an enlarged scale on heel. Color above (in alcohol) light brownish gray, each scale edged with dark brown and almost every other in the

longitudinal rows with this dark edge widened at the tip into a dark brown spot, while the rest of the scale is occupied by a whitish dot in such a manner as to form a regular system of oblique lines of bead-like spots from the middle of the back toward the flanks; top of head with dark brown edges to the shields and a few symmetrical whitish dark-edged dots on the shields of the parietal region; legs above with rounded whitish dots; tail obscurely banded, with darker and lighter brownish gray; underside pale.

Dimensions.

	mm.
Total length.....	107
Tip of snout to vent.....	40
Vent to tip of tail.....	67
Snout to ear.....	10.5
Axilla to groin.....	18
Fore leg.....	15
Hind leg.....	20

Family LACERTIDÆ.

TAKYDROMUS SEPTENTRIONALIS Guenther.

(Herpet. Japan, 1907, p. 232.)

1864. *Tachydromus septentrionalis* GUENTHER, Rep. Brit. India, p. 69.—*Tachydromus septentrionalis* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 50 (Pescadores, Taihoku, Koshun, Polisia, and Kelung).

Apparently the commonest species of the genus in Formosa.

TAKYDROMUS FORMOSANUS Boulenger.

(Herpet. Japan, 1907, p. 235.)

No additional specimens have been recorded which might throw light on the status of this species.

TAKYDROMUS SAUTERI Denburgh.

1909. *Tachydromus sauteri* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 50 (type-locality, Koshun, Formosa; type, Cal. Acad. Sci. No. 18001; H. Sauter, collector).

This addition to the Formosan fauna belongs to the section of the genus characterized by four pairs of submental shields. Like *T. wolteri* it has only one inguinal pore, but is described as having head and tail very elongate. The color is bright green above.

TAKYDROMUS KUEHNEI Denburgh.

1909. *Tachydromus kuehnei* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 50 (type-locality, Kanshirei, Formosa; type, Cal. Acad. Sci., No. 18002).

Belongs to the same section as the foregoing, but is distinguished by having 4 or 5 pores in each groin.

Family ANGUIDÆ.

Genus OPHISAURUS Daudin.

1803. *Ophisaurus* DAUDIN, Hist. Nat. Rep., vol. 7, p. 346 (type, *O. ventralis*).
 1820. *Hyalinus* MERREM, Tent. Syst. Amph., p. 79 (type, *O. ventralis*).
 1830. *Ophiosaurus* WAGLER, Nat. Syst. Amph., p. 159 (emendation).
 1853. *Dopasia* GRAY, Ann. Mag. Nat. Hist. (2), vol. 12, p. 389 (type, *D. gracilis*).
 1853. *Ophiseps* BLYTH, Journ. Asiat. Soc. Bengal, vol. 22 (p. 655), (type, *O. tessellatus*=*D. gracilis*).

OPHISAURUS, species.

1909. *Ophisaurus harti*? DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 60 (not of Boulenger?).

The addition of a "glass-snake" to the fauna of Formosa is very interesting, though for the present the species must remain in doubt. To explain the situation, I can do no better than quote Van Denburgh's own words, as follows:

The presence in Formosa of a species of *Ophisaurus* is attested by a specimen now in the Taiwan Medical School. This specimen was collected by the late Rev. Mr. Mackay, at Tamsue. Another specimen, collected at Shinchiku, was formerly in this museum, but has been lost. We have not as yet secured a specimen, but our collector states that individuals have been seen at Takao sunning themselves on a stone wall that borders a grove of screw pines.

The general relationship of the fauna would lead one to suspect that the *Ophisaurus* of Formosa is probably identical with Boulenger's *O. harti* from Fokien, China; but the notes which I have received concerning the specimen in the medical school indicate that the Formosan lizard is distinct. The matter must remain undecided until a specimen is received for examination.

Suborder SERPENTES.

Family TYPHLOPIDÆ.

TYPHLOPS BRAMINUS (Daudin).

(Herpet., Japan, 1907, p. 260.)

Specimens of this widely distributed blind-snake have been collected in Formosa by Swinhoe, Dickson, and Novara.

Family NATRICIDÆ.

Genus SIBYNOPHIS Fitzinger.

1843. *Sibynophis* FITZINGER, Syst. Rep., p. 26 (type, *Herpetodryas geminatus* Schlegel).
 1854. *Enicognathus* DUMÉRIL and BIBRON, Erpét. Gén., vol. 7, p. 328 (type, *H. geminatus*), (not of G. R. Gray, 1840).
 1876. *Henicognathus* COPE, Journ. Acad. Nat. Sci. Phila., vol. 8 (p. 138), (emendation), (not of Agassiz, 1846).
 1890. *Polyodontophis* BOULENGER, Fauna Brit. India, Rep., p. 301 (substitute for *Enicognathus*, preoccupied).

SIBYNOPHIS COLLARIS (Gray).

1853. *Psammophis collaris* GRAY, Ann. Mag. Nat. Hist. (2), vol 12, p. 390 (type-locality, Khasi Hills; types in Brit. Mus.; J. Hooker, collector).—*Polyodontophis collaris* BOULENGER, Fauna Brit. India, Rep., 1890, p. 302 (Himalayas; Assam; Arrakan; Upper Burma; S. China); Cat. Snakes Brit. Mus., vol. 1, 1893, p. 184, pl. 12, fig. 1; vol. 3, 1896, p. 597.—DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 50 (Kanshirei, Formosa).
1889. *Ablabes sinensis* GUENTHER, Ann. Mag. Nat. Hist. (6), vol. 4, (p. 220), (type-locality, Ichang, Upper Yangtse Kiang, China; type in Brit. Mus.; A. E. Pratt, collector).

Two specimens of this addition to the Formosan fauna, from Kanshirei, are recorded by Mr. Van Denburgh.

NATRIX STOLATA (Linnaeus).

(Herpet. Japan, 1907, p. 280.)

1758. *Coluber stolidus* LINNÆUS, Syst. Nat., 10 ed., vol. 1, p. 219.—*Natrix stolidus* BARBOUR, Proc. New England Zool. Club, vol. 4, Nov. 24, 1909, p. 67 (Central Formosa; Hainan).

A common species in Formosa. Mr. Barbour has recorded it from Mount Arizan, Central Formosa.

NATRIX PISCATOR (Schneider).

(Herpet. Japan, 1907, p. 288.)

No addition to my previous record.

NATRIX ANNULARIS (Hallowell).

(Herpet. Japan, 1907, p. 291.)

The same remark applies to this as to the foregoing species.

NATRIX SWINHONIS (Guenther).

(Herpet. Japan, 1907, p. 293.)

1868. *Tropidonotus swinhonis* GUENTHER, Ann. Mag. Nat. Hist. (4), vol. 1, 1868, p. 420.—BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, 1909, p. 495 (Kosempo, Formosa).

In addition to the unique type-specimen, the British Museum now has this species from Kosempo, collected by Mr. H. Sauter, as recorded by Boulenger.

NATRIX SAUTERI (Boulenger).

1909. *Tropidonotus sauteri* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1909, p. 495 (type-locality, Kosempo, Formosa; types in Brit. Mus.; H. Sauter, collector).
1909. *Natrix copei* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 52 (type-locality, Kanshirei, Formosa; type, Cal. Acad. Sci. No. 18004).

The name given by Boulenger to this interesting novelty has about twenty days priority over that given by Van Denburgh. According to the first-mentioned author it is allied to *N. swinhonis*.

Genus PSEUDOXENODON Boulenger.

1830. *Xenodon* WAGLER, Syst. Amph., p. 171 (type, *X. inornatus* BOIE) (not of Fitzinger, 1825).
1890. *Pseudozenodon* BOULENGER, Fauna Brit. India, Rep., p. 340 (type, *P. macrops*).

PSEUDOXENODON STEJNEGERI Barbour.

1908. *Pseudozenodon stejnegeri* BARBOUR, Bull. Mus. Comp. Zool., Cambridge, vol. 51, no. 12, p. 317 (type-locality, Mount Arizan, Formosa; type, No. 7103, M. C. Z. C.; Owston collection); Proc. New England Zool. Club, vol. 4, Nov. 24, 1909, p. 67, pl. 7, fig. 8 (type).

Only a single specimen from Mount Arizan, Central Formosa, was taken November 29, 1906. The species, according to its original describer, is related to *Pseudozenodon dorsalis* from China.

Genus MACROPISTHODON Boulenger.

1893. *Macropisthodon* BOULENGER, Cat. Snakes Brit. Mus., vol. 1, p. 265 (type, *M. flaviceps*).
1909. *Pseudagkistrodon* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 51 (type, *P. carinatus*).

The chief difference relied upon to distinguish *Pseudagkistrodon* from *Macropisthodon* is the lack of interspace between the anterior maxillary teeth and the posterior large fangs, a character scarcely sufficient in the present instance.

MACROPISTHODON CARINATUS (Denburgh).

1909. *Pseudagkistrodon carinatus* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 51 (type-locality, Formosa; type, Cal. Acad. Sci., No. 18003).

In addition to the type which seems to have no definite locality attached to it, specimens are recorded from Toroku and Mount Arizan, central Formosa.

Apparently the present form is very closely allied to the Chinese species *M. rudis*, which is recorded from Fokien and Yunnan. It agrees with it in the very strongly keeled scales, the keeled temporals, and in the presence of suboculars. The scale formula is also substantially alike in the two species, except that in the Chinese specimens recorded the scale rows are 25, but in the Formosan 23.

ACHALINUS FORMOSANUS Boulenger.

1908. *Achalinus formosanus* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 2, Aug. 1908, p. 222 (type-locality, Punkiho, Kagi district, Central Formosa; type in Brit. Mus.; Doctor Moltrecht, collector).

Beyond the type-specimen nothing is known of this interesting addition to the Formosan fauna. In spite of its large number of scale rows (27) it appears to be more nearly related to *A. spinalis* than to *A. rufescens*.

ENHYDRIS PLUMBEA (Boie).

(Herpet. Japan, 1907, p. 300.)

1827. *Homalopsis plumbea* BOIE, Isis, 1827, p. 550.—*Enhydris plumbea* BARBOUR, Proc. New England Zool. Club, vol. 4, 1909, p. 68 (Bankoro, Formosa; Hainan).

In addition to the Formosan specimens mentioned by me, Mr. Barbour has listed another from Bankoro, central Formosa.

ENHYDRIS BENNETTI (Gray).

(Herpet. Japan, 1907, p. 302.)

No further record of the occurrence of this snake in Formosa has been forthcoming since the issue of the Herpetology of Japan.

HURRIA RYNCHOPS (Schneider).

(Herpet. Japan, 1907, p. 304.)

The same remark applies to the present species as to the foregoing.

ELAPHE CARINATA (Guenther).

(Herpet. Japan, 1907, p. 308.)

Four specimens are thus far known from Formosa.

ELAPHE PORPHYRACEA (Cantor).

1839. *Coluber porphyraceus* CANTOR, Proc. Zool. Soc. London, 1839, p. 39 (type-locality, Mishmee hills, Assam).—BOULENGER, Cat. Snakes Brit. Mus., vol. 2, 1894, p. 34 (Eastern Himalayas; hills of Assam; Burma; Yunnan; Malay Peninsula; Sumatra); Proc. Zool. Soc. London, 1899, p. 165 (Fokien, China).—*Elaphe porphyracea* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 53 (Kanshirei, Shinchiku, and Giran, Formosa).
1839. *Psammodphis nigrofasciatus* CANTOR, Proc. Zool. Soc. London, 1839, p. 53 (type-locality, Singapore; type in Brit. Mus.; Cantor, collector).
1853. *Coronella callicephalus* GRAY, Ann. Mag. Nat. Hist. (2), vol. 12, p. 390, (type-locality, Khasi Hills; type in Brit. Mus.; J. Hooker, collector).

This is another east Himalayan species whose range has now been ascertained to extend to Formosa. Judging from the fact that the collector of the San Francisco Academy sent specimens from three different localities, it can not be very rare in the island.

ELAPHE RUFODORSATA (Cantor).

(Herpet. Japan, 1907, p. 310.)

Not recorded from Formosa since Swinhoe's time. He sent specimens from Tamsui to British Museum.

ELAPHE TÆNIURUS Cope.

(Herpet. Japan, 1907, p. 319.)

The record of this species in Formosa still rests on the two specimens in Museum Senckenbergianum in Frankfort-on-the-Main.

LIOPELTIS MAJOR (Guenther).

(Herpet. Japan, 1907, p. 338.)

1858. *Cyclophis major* GUENTHER, Cat. Colubr. Snakes Brit. Mus., p. 120.—*Liopeltis major* BARBOUR, Proc. New England Zool. Club., vol. 4, 1909, p. 69 (Formosa; Ichang, Hupeh, China).

The seventh specimen from Formosa, the female recorded by Mr. Barbour, I have had the privilege to examine. Its scale formula is as follows: Sc. 15; v. 169; a. 2; c. 92; oc. 3-2; t. 1+2; l. 8.

PTYAS MUCOSUS (Linnaeus).

(Herpet. Japan, 1907, p. 345.)

Three specimens are recorded from Formosa, one of them from Taiwan-fu.

PTYAS KORROS (Schlegel).

(Herpet. Japan, 1907, p. 348.)

ZAOCYS DHUMNADES (Cantor).

(Herpet. Japan, 1907, p. 352.)

Nothing has been recorded which will shed additional light on the status of these two species as members of the Formosan fauna.

Genus OLIGODON Boie.

1827. *Oligodon* BOIE, Isis, 1827 (p. 519) (type, *O. bitorquatus*).

OLIGODON ORNATUS Denburgh.

1909. *Oligodon ornatus* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 53 (type-locality, Shinchiku, Formosa; type, Cal. Acad. Sci. No. 18005).

The occurrence of a species of this essentially Indian and Malayan genus in Formosa is quite unexpected, as no member of the genus has hitherto been found in China. However, as one species has long been known from Assam, while two others have recently been described from Nepal and Burma, the present addition to the fauna of Formosa, or a closely allied species, may some day turn up in the intervening territory of China, from which many a novelty may yet be expected.

The type-specimen is the only one thus far recorded.

HOLARCHUS FORMOSANUS (Guenther).

(Herpet. Japan, 1907, p. 354.)

1872. *Simotes formosanus* GUENTHER, Ann. Mag. Nat. Hist. (4), vol. 9, Jan. 1872, p. 20.—*Holarchus formosanus* BARBOUR, Proc. New England Zool. Club, vol. 4, 1909, p. 69 (Mt. Arizan, Formosa).

Seems rather common in Formosa. Barbour maintains that the Hainan specimens form a distinguishable "local color variety."

DINODON • RUFOZONATUM (Cantor).

(Herpet. Japan, 1907, p. 358.)

Common in Formosa, though not recorded as being in any of the collections recently made there.

DINODON SEPTENTRIONALE RUHSTRATI (Fischer.)

(Herpet. Japan, 1907, p. 370).

Nothing has been added since.

CALAMARIA BEREZOWSKII Guenther.

(Herpet. Japan, 1907, p. 376).

1909. *Calamaria pavementata* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1, 1909, p. 495 (Kosempo, Formosa) (not of Duméril and Bibron?).

Boulenger suggests ^b that Guenther's *Calamaria berezowskii* "is probably not specifically separable" from *C. pavementata*. This may be so, but for the reasons given in my Herpetology of Japan, p. 375, I "can not consider the question finally settled," and therefore prefer to leave the nomenclature undisturbed until sufficient material shall have accumulated to make a final disposition of these forms possible.

BOIGA KRÆPELINI Stejneger.

(Herpet. Japan, 1907, p. 381).

1902. *Boiga kræpelini* STEJNEGER, Proc. Biol. Soc. Washington, vol. 15, p. 16.—*Dipsadomorphus kræpelini* BOULENGER, Ann. Mag. Nat. Hist. (8), vol. 4, Dec. 1909, p. 495 (Kankau and Kosempo, Formosa).

The additional specimens listed by Boulenger make it appear probable that this snake is not so rare as its late discovery might suggest.

PSAMMODYNASTES PULVERULENTUS (Boie).

(Herpet. Japan, 1907, p. 383).

Nothing added to the status of this snake in Formosa.

^a No further light has been shed on the alleged occurrence of *Lycodon aulicus* (Linnæus) in Formosa (Herpet. Japan, 1907, p. 358).

In this latter work (p. 356, footnote) I stated that inasmuch as Boie himself, in 1827, fixed *L. audax* as the type of *Lycodon*, which was established in 1826 without designated type, this generic name must be retained for the South American *Lycognathus*. It appears, however, that Fitzinger (Neue Class. Rept., 1826, pp. 29, 30) designated *Coluber aulicus* as the type of the genus, consequently previously to Boie, and as not even the latter himself, under the International Code, could undo the previous action of Fitzinger, the name *Lycodon* must be retained in the sense adopted by Boulenger.

^b Ann. Mag. Nat. Hist. (8), vol. 4, 1909, p. 495.

Family AMBLYCEPHALIDÆ.

(Herpet. Japan, 1907, p. 255.)

Genus AMBLYCEPHALUS Boie.

1822. *Amplycephalus* KÜHL, Isis, 1822, p. 474 (*nomen nudum*).
1827. *Amblycephalus* BOIE, Isis, 1827, p. 519 (type, *A. lævis*).
1830. *Pareas* WAGLER, Nat. Syst. Amph., p. 181 (type, *Dipsas carinatus*).

AMBLYCEPHALUS FORMOSENSIS Denburgh.

1909. *Amblycephalus formosensis* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 55 (type-locality, Kanshirei, Formosa; type, Cal. Acad. Sci. No. 18006).

This interesting novelty seems to hold a somewhat intermediate position between *A. monticola*, which occurs in the Eastern Himalayas, the Khasi hills and the Assam hills in Assam, and *A. moellendorffi* from southeastern China and Indo-China. With the former it shares scale-formula and enlarged median dorsals, with the latter the exclusion of the supralabials from the eye.

Family ELAPIDÆ.

CALLIOPHIS MACCLELLANDII (Reinhardt).

(Herpet. Japan, 1907, p. 391.)

1844. *Elaps macclellandii* REINHARDT, Calcutta Journ. Nat. Hist., vol. 4, p. 532.—
Callophis macclellandii DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 54 (Kosempo and Suishako, Formosa).

Van Denburgh simply remarks that specimens of this species have been received from the localities quoted above, but he does not give any scale formulas which would throw light on the question raised in the Herpetology of Japan, whether a high number of ventrals may not characterize a separate Formosan form.

CALLIOPHIS, species.

- Callophis* DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 54 (Giran, Formosa).

A specimen preserved in the Taiwan library is doubtfully referred to by Van Denburgh as possibly "an undescribed species." From the description furnished by his correspondent it appears that the scale formula and other external structural characters are essentially as in the specimen of *C. macclellandii* from Formosa described by me in the Herpetology of Japan. Among other characteristics it thus possesses 243 ventrals. The coloration, however, is very different, being longitudinally striped instead of transversely barred, and by the additional lateral white spots reminds one of the pattern of *Hemibungarus boettgeri*. This similarity might tempt one to suggest that the Giran specimen may belong to the latter genus rather than to *Calliophis*,

but against this it should be noted that Van Denburgh expressly states that "no small teeth could be made out on the right maxilla" (the left was found to be destroyed). However, considered in connection with my former statement (Herpet. Japan, p. 387) that *Calliophis macclellandii* and *Hemibungarus japonicus* (and consequently also *H. boettgeri*) "seem to be so closely related to each other that the latter appears less nearly allied to any of the other species of *Hemibungarus*," the suggestion seems justified that the Riukiuan species is genetically connected with the Formosan form here discussed. If so, the distinctness of the last-mentioned genus, as now defined, becomes very dubious indeed.

NAJA NAJA ATRA (Cantor).

(Herpet. Japan, 1907, p. 394.)

Beyond the single specimen in the British Museum, which Mr. La Touche collected near South Cape, Formosa, nothing has been recorded regarding the occurrence of the cobra in this island.

BUNGARUS MULTICINCTUS Blyth.

(Herpet. Japan, 1907, p. 397.)

Found both in northern and southern Formosa, and according to Mr. Tada common around Taipa.

LATICAUDA LATICAUDATA (Linnaeus).

(Herpet. Japan, 1907, p. 402.)

Apparently common along the coasts of Formosa.

[**LATICAUDA COLUBRINA** (Schneider).]

(Herpet. Japan, 1907, p. 406.)

No actual capture of this species on the coasts of Formosa has as yet been recorded, though there is every reason to believe that it occurs there.

[**LATICAUDA SEMIFASCIATA** (Reinwardt).]

(Herpet. Japan, 1907, p. 409, pl. 22.)

Occurring, as this species does, in the sea surrounding the neighboring islands of the southern Riukius and also in the Moluccan Sea, it may be looked for with confidence in Formosan waters as well.

EMYDOCEPHALUS IJIME Stejneger.

(Herpet. Japan, 1907, p. 413.)

In a recent paper ^a Doctor Boulenger admits the validity of the genus *Emydocephalus* and supplies several additional cranial charac-

^a Note on the Ophidian genus *Emydocephalus*, in Ann. Mag. Nat. Hist. (8), vol. 1, Mar. 1908, p. 231.

ters in support of it, but he still maintains the identity of the present species with *E. annulatus*. Doctor Wall, on the other hand, who in his two earlier papers^a supported Boulenger's view, in his recent Monograph of the Sea Snakes,^b comes to the same result as I, though quite independently of my arguments in the Herpetology of Japan, which had not reached him at the time he prepared his work.

DISTEIRA MELANOCEPHALA (Gray).

(Herpet. Japan, 1907, p. 421.)

It is equally gratifying to see that Doctor Wall, also quite independent of my action, has suppressed the genus *Hydrophis* and united it with *Disteira*,^c a procedure likewise indorsed by Mr. Van Denburgh and Doctor Thompson.^d

In his Monograph of the Sea Snakes, Doctor Wall not only unites *D. spiralis*, *brugmansii*, *melanocephala*, *subcincta*, *melanosoma*, *wrayi*, *floweri*, and *alcocki*, but suggests that *cyanocincta* and *lapemoides* "will eventually be united" with *D. spiralis*. It is quite possible that he is right or nearly right in this view, but I think he has to some extent anticipated what will "eventually" take place. In saying this I allude to the fact that he states that he considers them "all divided on insufficient grounds, affecting shields known to be subject to variation in this and other allied species." It is not reassuring to read that analogy from *other allied species* has to be invoked in order to effect this wholesale lumping. Even the fact that some of the characters relied upon for distinction are *subject to variation* is not in itself sufficient cause for uniting allied forms. Every herpetologist knows that in numerous cases of undoubtedly distinct species the variation of individual shields is so great that recourse has to be had to a combination of characters in order to phrase a diagnosis that will apply to most of the specimens. If Doctor Wall requires absolutely hard and fast lines in these snakes he may eventually be compelled to make further reductions in the number of species. Adding to these considerations the further fact that the difference between *D. spiralis* and *D. melanocephalus* is sufficiently marked to draw from him the admission "that *melanocephalus* is a local variety of *spiralis* characterized by rather fewer neck scales" (p. 212), I believe myself justified in retaining *Disteira melanocephala* as a distinct heading, at least for the present.

Beyond the specimen recorded by me from the Pescadores nothing further is known about this snake on Formosa, though it probably is common around the coasts of that island.

^a Proc. Zool. Soc. London, 1903, pp. 84-102, and 1905, vol. 2, pp. 511-517.

^b Mem. Asiatic Soc. Bengal, vol. 2, no. 8, 1909, p. 187.

^c Idem, p. 193.

^d Proc. California Acad. Sci. (4), vol. 3, Dec. 31, 1908, p. 41.

DISTEIRA CYANOCINCTA (Daudin).

(Herpet. Japan, 1907, p. 428.)

As for the status of this species I may refer to the remarks under the foregoing species. It appears to be common around Formosa.

[**DISTEIRA VIPERINA** (Schmidt).]

(Herpet. Japan, 1907, p. 434.)

As this species has been recorded from Hongkong and from Swatow, on the mainland side of the Formosa Channel, there is every reason to suppose that it also occurs on the island side, though not actually recorded from there as yet.

Genus **PELAMYDRUS**,^a new name.

1890. *Hydrus* BOULENGER, Fauna Brit. India, Rep., p. 397 (type *H. platurus*), (not of Schneider, 1799).—STEJNEGER, Herpet. Japan, 1907, p. 438.

Under article 30, 1, d, of the International Rules of Zoological Nomenclature, Pallas' *Coluber hydrus* becomes the type of Schneider's genus *Hydrus*.^b Latreille, in 1802, substituted for *Hydrus*, which he considered preoccupied by *Hydra*, the name *Hydrophis*.^c The following year Daudin, considering *Hydrophis* inappropriate, as these snakes inhabit the sea, substituted *Pelamis* for it.^d Both of these names being expressly designated as substitutes and without designated type must have for type the same species which is the type of *Hydrus*.^e Gistel's *Elaphrodites* of 1848 is in the same category, and the genus comprising Linnæus's well-known *Anguis platyrus* must be given a new name.

PELAMYDRUS PLATURUS (Linnæus).

1766. *Anguis platyrus* LINNÆUS, Syst. Nat., 12. ed., vol. 1, p. 391.—*Hydrus platurus* STEJNEGER, Herpet. Japan, 1907, p. 439.

“Of regular occurrence around Formosa.”

^a From *πηλαμῖς*, a young thunny, and *ὕδρος*, a water snake.

^b See opinion by International Committee of Zoological Nomenclature in Science (n. s.), vol. 31, Jan. 28, 1910, p. 150.

^c “Nous croyons devoir, pour éviter la confusion, substituer le mot *hydrophis*, qui veut dire serpent d'eau, à celui d'hydre ou d'*hydrus* de Schneider.” Hist. Nat. Rep., vol. 4, p. 193.

^d Ce genre comprend trois espèces * * * elles ont servi à Latreille pour former son genre *hydrophis*; mais comme elles habitent la mer, je les ai appelées de préférence *pélamides*, et j'ai substitué le nom d'*hydrophis* aux orvets à queue plate et venimeux qui vivent dans l'eau douce.” Hist. Nat. Rep., vol. 7, p. 361.

^e International Rules of Zoological Nomenclature, art. 30, II, f.

Family CROTALIDÆ.

AGKISTRODON ACUTUS (Guenther).

1888. *Halys acutus* GUENTHER, Ann. Mag. Nat. Hist. (6), vol. 1, 1888 (p. 171; pl. 12), (type-locality, mts. w. of Kiukiang, China; types in Brit. Mus., A. E. Pratt, collector).—*Ancistrodon acutus* BOULENGER, Cat. Snakes Brit. Mus., vol. 3, 1896, p. 524 (Ichang).—*Agkistrodon acutus* NAMIYE, Zool. Mag., Tokyo, No. 236, June 15, 1908, p. 192, pl.—DENBURGH, Proc. California Acad. Sci. (4), vol. 3, Dec. 20, 1909, p. 55 (Koshun and Shin-chiku, Formosa).

This interesting addition to the Formosan fauna was made by Namiye in 1908, and its occurrence in the island has since been corroborated by the collection made for the California Academy. Occurring, as it does, on the upper Yangtze Kiang and in the province of Fokien, opposite Formosa, its capture in the latter adds another fact to the many previous ones connecting its fauna with that of the Chinese mainland.

TRIMERESURUS MUCROSQUAMATUS (Cantor).

(Herpet. Japan, 1907, p. 467.)

1870. *Trimeresurus mucrosquamatus* SWINHOE, Proc. Soc. Zool. London, 1870, p. 411, pl. 31.—BARBOUR, Proc. New England Zool. Club, vol. 4, 1909, p. 75 (Bankoro, Central Formosa).

No additional light has been thrown on the occurrence of this species on the mainland, and the identity of the Formosan specimens with the species described from the "hills" in Assam remains still in obscurity. The specimen recorded by Barbour from Bankoro, in central Formosa, has the unusual number of 18 scales between the supraoculars, the latter being extremely narrow. Otherwise it comes within the limits of variation recorded by me.

TRIMERESURUS MONTICOLA Guenther.

1853. *Parias maculata* GRAY, Ann. Mag. Nat. Hist. (2), vol. 12, Dec. 1853, p. 392 (type-locality, Sikkim; type in Brit. Mus.; Dr. J. Hooker, collector), (not *Trimeresurus maculatus* GRAY, 1842).
1864. *Trimeresurus monticola* GUENTHER, Rep. Brit. India, p. 388, pl. 24, fig. B (type-localities, Nepal and Sikkim; types in Brit. Mus.; Hodgson and Hooker, collectors).—BARBOUR, Proc. New England Zool. Club, vol. 4, Nov. 24, 1909, p. 74 (Mt. Arizan, Central Formosa).—*Lachesis monticola* BOULENGER, Cat. Snakes Brit. Mus., vol. 3, 1896, p. 548 (Tibet, Himalayas, Assam to Malay peninsula and Sumatra).
1870. ? *Trimeresurus convictus* STOLICZKA, Journ. Asiatic Soc. Bengal, vol. 39, p. 224, pl. 12, figs. 1-1b (type-locality, Penang).

Another Himalayan species added to the Formosan fauna. Barbour in recording the fact remarks as follows:

Stejneger (Herp. of Japan, 1907, p. 480) wrote at the end of his remarks on *T. okinawensis* that no near ally of this species was known from Formosa. He notes its relationship to *T. monticola*, and says "the latter or a related form may be expected to

occur in that island [Formosa]." It is interesting to record now how correct Stejner's surmise was. A fine specimen from Tapposha, Mt. Arizan, central Formosa, was acquired with the Owston material. It is colored as Indian specimens are, but differs very slightly in having 10 scale separating the supraoculars and 10 supralabials. The scale rows are 27 in number, which Boulenger states is a rare condition. V. 155; anal entire; C. 46.

TRIMERESURUS GRAMINEUS (Shaw).

(Herpet. Japan, 1907, p. 480.)

1802. *Coluber gramineus* SHAW, Gen. Zool., vol. 3, pt. 2, p. 420.—*Trimeresurus gramineus* BARBOUR, Proc. New England Zool. Club, vol. 4, 1909, p. 76 (Bankoro, central Formosa).

Common. Barbour records two additional specimens.

Order TESTUDINATA.

Suborder ATHECÆ.

Family DERMOCHELIDÆ.

[*DERMOCHELYS SCHLEGELI* (Garman).]

(Herpet. Japan, 1907, p. 485.)

Not recorded from, but undoubtedly occurring occasionally, at least, in the waters surrounding Formosa.

Suborder LAMINIFERA.

Family TESTUDINIDÆ.

OCADIA SINENSIS Gray.

(Herpet. Japan, 1907, p. 489, pl. 28.)

Apparently common.

CLEMMYS MUTICA (Cantor).

1842. *Emys mutica* CANTOR, Ann. Nat. Hist., vol. 9 (p. 482), type-locality, Canton, China; type in Brit. Mus.; Cantor, collector.—*Damonia mutica* BOULENGER, Cat. Chel. Brit. Mus., 1889, p. 96 (Canton).—*Clemmys mutica* SIEBENROCK, Ann. Naturh. Hofmus. Wien, vol. 23, 1910, p. 312, pls. 12-13 (Formosa).
1855. *Emys nigricans* GRAY, Cat. Shield Rep. Brit. Mus., vol. 1, p. 20 (part: type-specimen of *E. mutica*).—SIEBENROCK, Sitz.-Ber. Akad. Wiss. Wien, vol. 112, 1903 (p. 439) (Ningpo, China).
1894. *Clemmys schmackeri* BOETTGER, Ber. Senckenberg. Ges., 1894 (p. 129, pl. 3, fig. 1 a-b) (type-locality, China, probably Hainan; type in Mus. Senckenberg.).

This addition to the fauna of Formosa was recorded by Doctor Siebenrock while the present paper was in the press. I can therefore only refer to his article, from which the above synonymy is derived. The Vienna Museum received eleven specimens from Fuhosho, South Formosa.

CYCLEMYS FLAVOMARGINATA Gray.

(Herpet. Japan, 1907, p. 503, pl. 33.)

The type of this species came from the Tamsui River, where, according to Swinhoe, it is the prevailing species.

Family CHELONIIDÆ.**[CARETTA OLIVACEA (Eschscholtz).]**

(Herpet. Japan, 1907, p. 507, pl. 34.)

As this marine species is common both to the north and the south of Formosa, it is pretty certain that it occurs also in the waters surrounding this island, though no record of actual capture is known as yet.

CHELONIA JAPONICA (Thunberg).

(Herpet. Japan, 1907, p. 509.)

Already cited as Formosan by Swinhoe under the name *Chelonia virgata*.

ERETMOCHELYS SQUAMOSA (Ghrard).

(Herpet. Japan, 1907, p. 511.)

Same remark as under foregoing species.

Suborder CHILOTÆ.**AMYDA SINENSIS** (Wiegmann).

(Herpet. Japan, 1907, p. 524.)

1834. *Trionyx (Aspidonectes) sinensis* WIEGMANN, Nova Acta Acad. Leop. Carol., vol. 17, p. 189.—*Amyda sinensis* BARBOUR, Proc. New England Zool. Club, vol. 4, 1909, p. 77 (Kagi, Formosa).

Two soft-shelled turtles from China (Cat. Nos. 39313–14, U.S.N.M.), collected by Mr. Sowerby in the Hoang-ho, at Honan-fu, province of Honan, 1,000 feet altitude, appear to me, after direct comparison, to be inseparable from Japanese specimens of the same size. They differ, consequently, as much from the Pechili specimens (*A. schlegelii*) as the Japanese specimens do. At present the Hoang-ho empties into the Gulf of Chili, not far from the mouth of the rivers in which *A. schlegelii* is at home, but this embouchure is only a recent one, as prior to 1852 the Yellow River emptied into the sea not far from the mouth of the Yang-tse-Kiang, the lower part of these two river systems being more or less connected through extensive lakes and swamps, as well as canals. Whether the soft-shelled turtles from these two rivers are identical, time alone will show, and as the type-locality of *A. sinensis* is Macao, the question of the latter's relation to the above and to the Formosan forms is equally for the future to answer.

[DOGANIA SUBPLANA (Geoffroy-Saint-Hilaire).]

(Herpet. Japan, 1907, p. 531.)

The occurrence of this species in Formosa is still very problematical.

THE PHYLOGENETIC INTERRELATIONSHIPS OF THE RECENT CRINOIDS.

By AUSTIN H. CLARK,

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In the present enlightened epoch of comprehensive zoological thought, one is justly considered as antiquated and narrow-minded if, in the study of any group of organisms, careful attention is not given to their fossil representatives. Yet in many cases the combination of recent species with their fossil representatives and near relations forms a mass very difficult of mental digestion, and it is found that the best results are attained by studying each component separately and then combining the acquired data.

The study of the Crinoidea has always been approached from the paleontological standpoint as a natural corollary of the preponderance of the fossil over the recent species; but a comparative study restricted to recent forms alone brings out certain points well worthy of consideration, and emphasizes certain facts not so evident if recent and fossil species are studied all together.

In the present paper all the recent crinoid groups will be taken up and their various interrelationships shown, without reference to any of their fossil relations, as if there were none but recent crinoids, in the hope that this unique and more or less illogical treatment will call attention to certain points hitherto more or less obscured.

In studying the recent crinoids I have become impressed with the fact that the stems offer the best criteria for tracing out phylogenetic relationships; a critical study of the stems has shown that all the types converge, both phylogenetically and (where observations have been possible) ontogenetically to a common center. Next in importance to the stems come the basals, and using these two structures alone we can form a very satisfactory phylogenetic tree.

On the characters offered by the stem and basals, the recent crinoids fall into three sharply differentiated groups, as follows:

*a*¹. Stem short and stout, unjointed. *Holopus*.

*a*². Stem long and slender, with many joints.

*b*¹. Stem without cirri or nodes; the basals are inclined upward more or less toward a position parallel to the dorso-ventral axis, enclosing a cup-shaped cavity, and form part of the lateral body wall.

Phrynocrinus; Ptilocrinus; Calamocrinus; Hyocrinus; Gephyrocrinus; Bathyrcrinus; Rhizocrinus.

*b*². Stem with cirri, forming one or more nodes; the basals are horizontal, or have become metamorphosed, and do not form part of the lateral body wall.

Comatulida; Pentacrinetida.

Were there no such things as fossil crinoids, each of these groups would have the standing of an order; and for the purposes of this paper they may be referred to as (1) the Holopida, (2) the Ptilocrinida, and (3) the Comatulida.

The stem of *Holopus* is of the simplest possible construction, being practically but a simple thickening of the primitive central plate. Our Holopida therefore are a surviving early offshoot from the main line of descent, representing a developmental stage of great antiquity, before the inception of articulations in the crinoidal base.

I have elsewhere shown that the theoretically most primitive type of articulated crinoidal columnar is that found in *Rhizocrinus*, and, especially, *Bathycrinus*; these two genera, therefore, stand at the foot of the Ptilocrinida, though not on the same plane, for the second is much more specialized than the first. The stem of *Phrynocrinus* is a curious and unique adaptation of the primitive articulated columnar to a great increase in size and the necessity of supporting a greatly increased weight; the individual columnars of *Phrynocrinus* are morphologically the same as those of *Bathycrinus*, but modified by being greatly shortened, the diminution in length being correlated with a broadening of the terminal ellipses. The family Phrynocrinidæ therefore marks the furthest development in the line of the simplest possible adaptation to increasing stress of a column of the type found in the Rhizocrinidæ. In very large specimens of *Bathycrinus* we notice that the primitive fulcral ridge on the articular faces of the columnars shows a tendency to form a pair of triangular structures with their apices at the central canal, and these triangular, or more properly fan-like, structures are marked more or less distinctly with radiating lines. This indicates a second line of adaptation to increased stress, which eventually results in the formation of circular articular surfaces uniformly covered with radiating lines. Such articular surfaces are common to *Ptilocrinus*, *Calamocrinus*, *Gephyocrinus*, and *Hyocrinus*, and therefore we should group these four genera together (a course already in part indicated by Doctor Bather) making of them the superfamily Hyocrinoida which, most obviously on the basis of the arrangement of the brachials, falls into two families, Ptilocrinidæ and Hyocrinidæ.

The great order of the Comatulida, and the family Pentacrinitidæ, to which the vast majority of the recent forms belong, represent a higher state of development and phylogenetic (as opposed to generic or family) specialization than the Ptilocrinida; for we find that the primitively uniform stem of the latter in this group is modified by the development, at regular intervals, of cirriferous nodes; and the basals, which throughout the echinoderms form part of the body wall and in the Heteroradiata lie in the same plane as the radials, forming in con-

junction with them a dorsal cup, here have come to lie horizontally, have moved inward, and have become more or less atrophied or metamorphosed, taking no part whatever in the formation of anything but the bottom of the cup. The Comatulida are sharply divided into two parts: (1) Those species in which the stem is retained throughout life, and (2) those in which it is cast off at an early stage—the Pentacrinitidæ and the Comatulida.

So far as can be judged from the available facts, the earlier stage of these two groups is the same; a dorso-central like that of *Phrynocrinus*, or a root like that of *Rhizocrinus*, supports a *Bathycrinus*-like stem, which in turn bears a crown in which the basals are large and form part of the dorsal cup exactly as in *Rhizocrinus*, and large orals are present, as in the Holopida and Ptilocrinida generally. But after the formation of a certain number of columnars, approximately definite for each species, a specialized columnar is formed which is united to the preceding by a plane articular surface instead of by an articular surface comprising the usual fulcral ridge and ligament fossæ, and which gives off radially five articulated processes, the cirri. At this stage the basals, at first large and an important and essential part of the wall of the calyx cup, have considerably diminished in their external size, due to having become more recumbent in position, and to having slipped inward under the central part of the dorsal cup.

From this point onward the paths of the Pentacrinitidæ and the Comatulida diverge. In the former a new series of columnars, resembling the first series, is added on top of the cirriferous nodal, this series also terminating, as did the first, in a nodal, a second cirriferous columnar, separated from the first by about the same number of ordinary columnars as separated the first from the dorso-central. This process is continued; new columnars are added one by one, every so often one being formed with a whorl of cirri; with increasing size the columnars gradually become shorter, and the primitive fulcral ridge little by little spreads out into two fan-like figures, which have indicated radiating lines. The structure of the basals has not changed since the formation of the first nodal and its whorl of cirri; they are much reduced in size and lie horizontally so that their sides are dorsal and ventral, and their edges outward. As each columnar is formed, either directly under the basals or, in later life, by intercalation between the upper columnars, it is cast in a mold formed by the underside of the basals, and thereby becomes modified by the acquisition of petaloid markings, more or less obscuring the primitive radiating lines which otherwise would have been formed.

In the Comatulida, stem development ceases when the first nodal is formed; but the nodal itself greatly increases in size, and usually adds several additional rows of cirri to the first; coincidentally the basals slip farther and farther inward, disappearing from sight alto-

gether,^a and fusing so as to form the so-called rosette; the stem, now become too delicate to support the growing animal, breaks off at the modified articulation just under the nodal, and the animal becomes a so-called free form.

It is interesting to notice that in the adults of the Pentacrinitidæ and Comatulida the radials have undergone a considerable change comparable to that undergone by the basals. Primarily large broad plates forming an important part of the calyx wall, as seen in the Ptilocrinida, they have gradually become recumbent, and have attained an almost or quite horizontal position. Their inferior ends, originally abutting on the superior ends of the basals, with which they form, as in the young of *Antedon*, a smooth, regularly-rounded cup, have, as the basals became more and more recumbent, gradually slipped inward, so as to become attached to what was at first the inner side of the basals. When the radials in their turn became recumbent their lower ends slipped inward along the upper (originally inner) surface of the basals, so that finally the radials come to form a circlet of almost or quite horizontal plates, superposed upon the similar circlet of horizontal basals. The infrabasals long ago underwent a similar transformation, and in the Comatulida and in the pentacrinite genus *Endozocrinus* have been quite lost. Morphologically, therefore, the calyx of the Comatulida and Pentacrinitidæ is composed of three alternating circlets of five plates each, superposed horizontally upon each other, so that the first two have entirely lost their original function of serving as a protection to the calyx contents, and the third, or uppermost, merely forms the central part of the calyx floor, having for its chief function the support of the arms.

The changes undergone by the plates of the calyx which primarily form a cup about the calyx contents are accompanied by a gradual extrusion of the calyx contents, so that these (the so-called disk) come to be supported more and more by the arm bases, and in the Pentacrinitidæ and Comatulida rest upon the post-radial ossicles to and including the second of the undivided arm. In many cases these ossicles have spread out laterally, and are in close lateral apposition, so that they have taken on the function of the original calyx plates and form a solid calcareous wall enclosing and protecting the "soft parts."

Exactly the same thing has taken place in *Bathyrinus*, but by a radically different process; instead a diminution of the interior volume of the calyx cup by the attainment gradually of a horizontal position and a slipping inward of the calyx plates, the basals and radials have moved inward without at all changing their original relationships, but with the same result of causing the "soft parts" to be extruded and to be supported by the post-radial ossicles.

^a Except in *Atelecrinus*, where the basals are retained in the condition of those of the Pentacrinitidæ.

NEW HYMENOPTERA FROM THE PHILIPPINE ISLANDS.

By J. C. CRAWFORD,

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The species described in this paper were for the most part collected by the Rev. Robert E. Brown, S. J., although a few are from the material gathered by the Rev. William A. Stanton, S. J. Under each species credit has been given to the collector. In the Philippine Journal of Science ^a Father Brown has given a list of the species of Hymenoptera found in the islands and has cited several names sent him by the late Dr. W. H. Ashmead which are manuscript names. In describing these species, of which no manuscript has been found, the names used by Doctor Ashmead have been adopted.

Superfamily APOIDEA.

Family CERATINIDÆ.

CERATINA TROPICA, new species.

Female.—Length 6–6.5 mm. Black, with the following yellow markings: A transverse line on anterior margin of clypeus, slightly wider medially, one on anterior margin of supraclypeal area, a spot on each side of face below, one opposite insertion of antennæ, two small spots back of antennæ, a long line on posterior orbits, collar, tubercles, a large spot on scutellum, narrow transverse line on abdominal segments 1–5, those on segments 1, 4, and 5 dilated medially, those on 2, 3, and 4 narrowly interrupted medially; head coarsely punctured; mesothorax closely, more finely punctured, the punctures crowded, the disk impunctured; base of metathorax very finely longitudinally wrinkled, the wrinkles not reaching the apex, the apex finely lineolate; mesopleuræ closely punctured; wings slightly dusky; tegulæ almost black, veins of wings dark brown; legs black, knees, outer side of anterior tibiæ, and first joint of hind tarsi yellowish-white; tarsi reddish; first three segments of abdomen closely punctured, following segments rugoso-punctate.

Male.—Length 5.5 mm. Similar to the female, markings differing as follows: Labrum yellow; mark on clypeus with a longer upward

^a Vol. 1, pp. 683 to 695.

extension; spots on sides of face connected; outer side of all tibiæ yellowish-white; front tibiæ reddish; bands on segments 2 and 3 widely interrupted; a band on sixth segment.

Manila, P. I. (Robert E. Brown, collector.)

Type.—Cat. No. 12885, U.S.N.M.

Family ANDRENIDÆ.

Subfamily HALICTINÆ.

NESOHALICTUS, new subgenus.

Closely resembles *Halictus*, but differs by the greatly elongate tongue, which is about as long as the antennæ, by having the inner spur of the hind tibiæ in the male armed with a few large teeth, and by having all the transverso-cubital veins, the cubitus beyond the second transverse cubital, and the upper two-thirds of the second recurrent vein, obsolescent.

Type.—The following species.

HALICTUS (NESOHALICTUS) ROBBII, new species.

Male.—Length 6–6.5 mm. Black, head and thorax finely lineolated, covered with long, whitish, plumose pubescence, clypeus greatly produced, with scattered large, weak punctures, punctures of the supraclypeal area closer; above antennæ the punctures fine, crowded; antennæ reddish beneath, joints two and three short, together hardly as long as the fourth; mesothorax finely reticulated with scattered fine punctures, the reticulations appearing as punctures, except under a high power; median and parapsidal furrows apparent; metathorax irregularly rugulose, with an indistinct basal inclosure, which is not pubescent; truncation surrounded by a hexagonal carina; wings slightly dusky, stigma and veins light colored; legs brown, tarsi reddish, hind inner spur with a few large teeth; abdomen closely, finely punctured; segments 2–4 with small basal hair patches.

Female.—Unknown.

Manila, P. I. (Collected by M. L. Robb and R. E. Brown.)

Type.—Cat. No. 12886, U.S.N.M.

Named for M. L. Robb, the collector.

Superfamily SPHECOIDEA.

Family PHILANTHIDÆ.

CERCERIS LUZONENSIS, new species.

Male.—Length 7 mm. Black, coarsely and closely punctured, more closely so on pleuræ; enclosed place at base of metathorax longitudinally striate; scape except a line above, broad inner margins of eyes to above level of insertion of antennæ, spot at base of

clypeus, a spot on each side of prothorax, spot on tegulæ, postscutellum almost entirely, anterior and middle tibiæ and tarsi, basal half of hind tibiæ, spot at base of segment 2, small spot on each side of segments 2 and 4 at apex, apical half of segments 3 and 6, yellow; lateral angles of clypeus strongly produced; wings dusky, the anterior margin with a more deeply infuscated band; bases of abdominal segments strongly constricted; venter black, first segment with a median keel basally, third segment with a transverse yellow band.

Manila, P. I. (R. E. Brown, collector.) One specimen.

Type.—Cat. No. 12887, U.S.N.M.

Superfamily VESPOIDEA.

Family TIPHIIDÆ.

TIPHIA ASHMEADI, new species.

Male.—Length 4.75–6 mm. Black, sparsely pubescent, the pubescence at apex of abdomen golden; head and thorax finely reticulated; antennæ reddish beneath, joints two and three subequal, together longer than four; clypeus produced, with small, well-separated punctures; punctures immediately above antennæ close, in front of ocelli, sparse; those along inner orbits close almost up to ocelli; thorax, including scutellum and postscutellum, sparsely punctured; propleuræ finely lineolated, mesopleuræ reticulated and punctured, metapleuræ longitudinally striated except at front beneath where they are strongly lineolated; metathorax with three straight, longitudinal carinæ, the outer ones converging slightly towards apex, between them coarsely sculptured, lateral areas transversely rugulose basally; truncation of metathorax closely sculptured all over; tegulæ black with a broad reddish margin, reticulated; wings slightly dusky, veins light brown, stigma dark brown; legs black, front and middle femora at apices together with the tibiæ and tarsi, brownish; abdomen shiny, sparsely punctured, more closely so on apical segments; segments 2 to apex reticulated.

Manila, P. I. (R. E. Brown and W. A. Stanton, collectors.)

Type.—Cat. No. 12824, U.S.N.M.

Named for the late Dr. W. H. Ashmead.

TIPHIA LUCIDA, new species.

Male.—Length about 6 mm. Closely related to *T. ashmeadi*; head and thorax not reticulated; joint three of antennæ distinctly longer than two; clypeus not produced, with large, close punctures; punctures along inner orbits close almost up to ocelli; tegulæ reticulated at rear; mesopleuræ not reticulated; truncation of metathorax at top smooth, below coarsely sculptured; punctures of scutellum close, coarse; of postscutellum close, very coarse; metathorax with three longitudinal carinæ, the outer ones converging toward apex and

curved inwardly; between them not coarsely sculptured; the apical part of inclosure smooth, the median carina not reaching apex; abdomen sparsely punctured, not reticulate.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12825, U.S.N.M.

TIPHIA SEGREGATA, new species.

Male.—Length 6 mm. Closely related to the two species described above; head and thorax not reticulated; joints two and three of antennæ subequal; clypeus not produced, with small, well-separated punctures; punctures along inner orbits not close; punctures of thorax, including scutellum and postscutellum, sparse; metathorax with three carinæ, the outer ones straight, converging toward apex, between them coarsely sculptured; truncation sculptured all over; tegulæ smooth; mesopleuræ not reticulated; abdomen sparsely punctured, not reticulated.

Female.—Length 6.5 mm. Similar to the male, below antennæ finely roughened and with scattered punctures, the clypeus apically smooth; above antennæ with sparse coarse punctures; metathoracic carinæ, as in male; sculpture of metathorax, entirely fine.

Manila, P. I. (R. E. Brown and W. A. Stanton, collectors.)

Type.—Cat. No. 12826, U.S.N.M.

Superfamily PROCTOTRYPOIDEA.

Family DIAPRIIDÆ.

LOXOTROPA TRICORNUTA, new species.

Female.—Length 2.5 mm. Deep mahogany brown, head black, the face brown; antennæ, legs, and abdomen apically lighter brown; head in front of ocelli with lateral and a median processes; the lateral ones larger; all the prominences with sharp points; from the median one a carina runs downward between antennæ; prominence on which antennæ are inserted large, front of prominence with a median carina extending down to mouth parts; antennæ about 2 mm. long; scutellum at base unifoveate; prothorax and metathorax covered with pubescence; metathorax with a median carina and lateral carinæ, forming two depressed areas; median carina at base elevated into an angular prominence; metathorax at apex produced, emarginate; wings slightly yellowish; first segment of abdomen occupying most of surface.

Male.—Length 2.5 mm. Similar to the female; antennæ over 3 mm. long.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12888, U.S.N.M.

LIPOGLYPTUS, new genus.

Antennæ thirteen-jointed in both sexes, inserted on a strong frontal prominence, very slightly enlarged toward apex in female, filiform in male; the scape very long in the female; prothorax long, truncate in front; mesothorax without furrows; scutellum foveate at base, each side with an elongate fovea extending to the apex of the scutellum, these foveæ with carinate sides; metathorax with median and lateral longitudinal carinæ; submarginal vein reaching the anterior margin of wing slightly before the middle of the wing; marginal vein long, stigmal vein very short, hardly visible; basal vein indicated by an infuscated line in the female, not at all indicated in the male; petiole long, fluted.

In Doctor Kieffer's classification of the Diapriinæ this genus comes near *Hemilexodes* Ashmead.

Type of genus.—*Lipoglyptus primus* Crawford.

LIPOGLYPTUS PRIMUS, new species.

Female.—Length 3–3.5 mm.; antennæ over 2 mm. Black, smooth, shiny, head and thorax with sparse, long hairs; scape of antennæ dark brown, pedicel and first four joints of funicle lighter brown; beyond, orange; pedicel short, about two-thirds as long as the first joint of the funicle; joints two to five of funicle gradually decreasing in length, the following joints subquadrate, the apical joint over twice as long as wide; median carina of metathorax greatly elevated, especially at base; pro- and mesopleuræ smooth; metapleuræ with large longitudinal grooves; wings deeply infuscated, marginal fringes short; tegulæ and legs, including coxæ, brown; femora and tibiæ pedunculate; first segment of abdomen occupying most of surface.

Male.—Length about 2.5 mm.; antennæ over 5 mm. Similar to the female; antennæ reddish brown; pedicel short, as long as the first joint of the funicle; following joints of antennæ greatly elongate; second joint of funicle near base above with a short carina; median carina of metathorax less elevated than in female; grooves of metapleuræ indistinct, the surface finely roughened; legs lighter in color; wings not so deeply infuscated.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12889, U.S.N.M.)

COLOGLYPTUS, new genus.

Antennæ with thirteen joints, the club four-jointed; submarginal vein reaching the anterior margin of the wing about one-third the distance from the base of the wing to the apex; eyes hairy; wing without a basal vein; parapsidal furrows visible only posteriorly, deep; scutellum with two foveæ at base and along each side a fovea;

metathorax with a median carina which basally is elevated into an angulated prominence.

Type of genus.—*Cologlyptus kiefferi* Crawford.

In Doctor Kieffer's table of the Diapriinæ^a this genus runs nearest to *Basalys*.

COLOGLYPTUS KIEFFERI, new species.

Female.—Length about 2 mm. Deep brown, the abdomen at base of second segment and along sides more or less inclining to reddish testaceous; the whole insect smooth and shining, head and thorax with long pubescence, abundant on prothorax, metathorax, and petiole; antennæ light brown, flagellum inclining to reddish, the club dark brown; joints of flagellum, except first, almost subquadrate; the first about as long as the pedicel; scutellum at apex with a transverse row of punctures; postscutellum with a median longitudinal carina; metathorax on each side of median carina with a longitudinal carina having a branch on each side, the one directed laterad at about the middle, the one directed mesad near base, so that the metathorax is areolated; petiole fluted; legs yellow, the femora strongly pedunculate; first segment of the abdomen occupying most of the surface.

Male.—Unknown.

Manila, P. I. Three specimens collected by R. E. Brown.

Type.—Cat. No. 12890, U.S.N.M.

Dedicated to Dr. J. J. Kieffer.

Family SCELIONIDÆ.

Subfamily BAEINÆ.

ACOLUS LUTEIPES, new species.

Female.—Length 1 mm. Black; face with a vertical carina extending from the anterior ocellus to the mouth parts, upper part of face closely punctured, the lower part vertically striate; flagellum four-jointed, joints of club so closely fused as to make the club appear one-jointed; mesonotum closely punctured, punctures of the scutellum sparse, fine; scutellum apically margined; wings slightly dusky; the submarginal vein long; basal vein short; legs yellow; first segment and second segment of abdomen medially with longitudinal striæ, rest of abdomen closely punctured with the apical margins of segments narrowly impunctured.

Manila, P. I. (R. E. Brown, collector).

Type.—Cat. No. 12891, U.S.N.M.

This species in Father Brown's catalogue of the Philippine Hymenoptera is listed under the manuscript name used by Doctor Ashmead of *Hadronotus luteipes*.

^a Ann. Mus. Stor. Genova, vol. 42, 1905, p. 33.

Subfamily TELEASINÆ.

PROSACANTHA ROBERTI, new species.

Male.—Length 1 mm. Black, petiole and base of first abdominal segment yellow; head smooth and shiny; below antennæ vertically striate; the antennæ almost twice the length of the body, the scape testaceous, rest of antennæ brown; mesothorax finely punctured, the scutellum smooth; metathorax with a distinct median carina; sclerites of mesopleuræ separated from each other by a row of pits; wings very long and narrow, dusky, the marginal fringes very long, front wings on the posterior margin near base produced to a distinct point; petiole, basal half of first segment, and base of second with longitudinal striæ.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12892, U.S.N.M.

PROSACANTHA STRIATICEPS, new species.

Male.—Length 1.5 mm.; antennæ 2.5 mm. Black, the first segment of the abdomen red; face except medially above antennæ, vertically striate; clypeus transversely striate, the lateral angles produced; head behind eyes finely punctured; mandibles testaceous; antennæ brown, the third joint of the funicle at base with an elevated carina and not excised; mesonotum finely punctured; scutellum just before apex with a transverse row of large punctures, behind them smooth, shiny; metathorax rugose; wings dusky; legs rufo-testaceous; first and second segments of abdomen and the third basally and laterally, longitudinally striate.

Manila, P. I. (R. E. Brown, collector.) One specimen.

Type.—Cat. No. 12893, U.S.N.M.

Subfamily SCELIONINÆ.

HABROTELEIA BROWNI, new species.

Female.—Length 4.5 mm. Black, scape, tegulæ and legs including coxæ, rufo-testaceous; head coarsely punctured; parapsidal furrows consisting of a row of large punctures; middle lobe of mesonotum with a median longitudinal depressed area which is finely punctured; mesonotum along sides and anterior margin with a single row of large punctures, anteriorly the middle lobe finely punctured; elsewhere the mesonotum is almost impunctured, smooth, polished, scutellum at base with a row of large pits, coarsely punctured, near apex with a transverse row of punctures, back of this smooth; postscutellum with large pits and a short median spine; metathorax with a long median spine and the sides greatly prolonged caudad to form the socket for the abdominal spine; wings deeply infuscated, reaching beyond the apex of the fourth abdominal segment; abdomen including basal horn,

longitudinally striate, between the striæ with punctures, the second segment near base with a semicircular row of large pits; venter longitudinally striate and punctured between the striæ.

Manila, P. I. Two specimens.

Type.—Cat. No. 12894, U.S.N.M.

Named in honor of Father R. E. Brown, who collected the specimens.

PLATYSCELIO ABNORMIS, new species.

Male.—Length about 3.5 mm. Black, shiny, greatly flattened, the antennæ twelve jointed, filiform, rufo-testaceous; scape flattened, enlarged toward apex, pedicel short, not longer than wide; joints of the flagellum elongate, the third with a short carina on one side; three ocelli present, the ocellar triangle longitudinally striate; head with a strong median carina bifurcated at each end, the bifurcations at the posterior end embracing the anterior ocellus, those at the anterior end running to each antenna; head smooth, polished, a single row of punctures along the anterior orbits of the eyes; middle lobe of mesothorax longitudinally punctate-striate, the lateral lobes punctured only anteriorly, the disk smooth but with a short indistinct furrow; scutellum near apex with a single transverse row of punctures, interrupted medially; metathorax striate laterally, the median area smooth, with a longitudinal furrow which posteriorly bifurcates; wings slightly dusky, reaching beyond the apex of the fourth segment, the marginal vein long, the stigmal short, the postmarginal wanting; legs testaceous; abdomen closely longitudinally striate-punctate; the lateral carinæ distinct to the middle of the fifth segment.

Manila, P. I. One specimen collected by R. E. Brown.

Type.—Cat. No. 12895, U.S.N.M.

MACROTELEIA STRIATIVENTRIS, new species.

Female.—Length 5 mm. Black, the scape of antennæ and the legs, including the coxæ reddish-testaceous; pedicel brown, the apex lighter, funicle brown, the club black; head and thorax with rather close, coarse punctures; meso- and metapleuræ longitudinally striate, the striæ of the anterior part of the mesopleuræ with punctures in the interstices; wings slightly dusky reaching beyond the middle of the fourth segment; veins brown, the postmarginal about twice as long as the marginal; abdomen longitudinally striate, the third segment distinctly longer than second, the fourth about as long as the second and longer than the fifth; sixth segment longer than fifth, viewed in profile, slender, the line of the dorsum straight.

Male.—Length 4.5 mm. Similar to the female, the wings reaching almost to the apex of fourth segment; sixth and seventh segments short, the seventh segment without prongs at apex.

Manila, P. I. (R. E. Brown, collector.) Four specimens.

Type.—Cat. No. 12896, U.S.N.M.

MACROTELEIA KIEFFERI, new species.

Female.—Similar to *M. striativentris*; black, scape and legs, including coxæ reddish-testaceous; meso- and metapleuræ punctured; wings reaching beyond apex of fourth segment; veins light, the postmarginal not much longer than the marginal; segments two and three of abdomen subequal, the fourth shorter, longer than the fifth; sixth segment about as long as fourth, viewed in profile the line of the dorsum slightly curved.

Male.—Unknown.

Manila, P. I. (R. E. Brown, collector.) Two specimens.

Type.—Cat. No. 12897, U.S.N.M.

Named for Rev. J. J. Kieffer.

MACROTELEIA MANILENSIS Ashmead.

Female.—Length 3.25 mm. Very similar to the two species described above, the mesopleuræ punctured, the metapleuræ striate; wings reaching beyond the apex of the fifth segment, the veins light colored, the postmarginal not much longer than the marginal; segments two and three of abdomen subequal, the fourth much shorter but longer than the fifth, the sixth about as long as the fourth and viewed in profile with the line of the dorsum strongly curved.

Male.—Similar to the female in structure of the pleuræ; last segments of abdomen with two prongs at apex.

Manila, P. I. (R. E. Brown, collector.)

Doctor Ashmead, when describing this species, had before him only a male specimen.

Superfamily CHALCIDOIDEA.

Family TORYMIDÆ.

Subfamily MONODONTOMERINÆ.

DIMEROMICRUS, new genus.

Antennæ 13-jointed with two ring joints; in the male these ring joints so minute as to appear as one, except under high magnification; funicle six-jointed; occipital foraminal depression margined; scutellum without a cross furrow; abdominal segments incised medially; front femora normal; pronotum short; hind femora almost smooth beneath, excised at apex; eyes bare; marginal vein about as long as submarginal; stigmal knob subsessile; postmarginal vein hardly longer than stigmal knob.

Plesiostigmodes the only other genus in the subfamily having two ring joints, differs in having the front femora much swollen and the pronotum longer than the mesonotum.

Type of genus.—*Dimeromicrus ashmeadi* Crawford.

DIMEROMICRUS ASHMEADI, new species.

Female.—Length 1.6 mm. Head and thorax bluish green; abdomen medially brown; head finely lineolated; antennæ brown; scape yellow; thorax transversely lineolated; legs yellow; coxæ and hind femora except tips green; abdomen very finely lineolated; ovipositor about as long as abdomen.

Male.—Length 1.4 mm. Similar to female, but more brassy green; mesothorax more coarsely sculptured, abdomen more yellowish.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12898, U.S.N.M.

Dedicated to the late Dr. W. H. Ashmead.

Subfamily PODAGRIONINÆ.**PODAGRION PHILIPPINENSIS, new species.**

Female.—Length 2.25 mm., ovipositor 3 mm.; deep blue, antennæ brownish, scape lighter, ring joint small; head and thorax closely reticulated by slightly raised lines, becoming stronger toward rear of mesonotum and on scutellum; parapsidal areas almost smooth, the reticulation very indistinct; scutellum posteriorly and axillæ impunctate; base of metathorax with two diverging carinæ running backward from medial anterior margin, these joined by two running forward from apex of metathorax forming a diamond-shaped area; this area finely rugose, rest of metathorax coarsely rugose; front and middle femora brown, hind bluish; tibiæ mostly brownish, tarsi light; hind femora with nine teeth.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12899, U.S.N.M.

PODAGRION ASHMEADI, new species.

Female.—Length 2.75 mm.; ovipositor about 4 mm.; head and thorax dull green, abdomen yellowish, with the base metallic and apical half brown; head closely and strongly punctured; antennæ yellowish, club dark, ring joint longer than wide; pro- and mesothorax finely rugoso-punctate, becoming larger, distinct punctures on rear of mesonotum and scutellum; rear of scutellum and axillæ impunctate, finely roughened; parapsidal grooves obscured by roughness of sculpture; metathorax irregularly rugose, slightly back of middle with a transverse ruga stronger than the rest; front and middle legs, including coxæ, yellow; hind coxæ at base metallic, rest yellowish; hind femora and tibiæ more or less obscured with dusky, their tarsi yellowish; hind femora with eight teeth.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12900, U.S.N.M.

Named for Dr. W. H. Ashmead.

Family CHALCIDIDÆ.

Subfamily CHALCIDINÆ.

Tribe CHALCITELLINI.

ANACRYPTUS STANTONI Ashmead.

This species was described by Doctor Ashmead in the genus *Arretocera*, but the specimens show on the hind tibiæ the tooth which characterizes the genus *Anacryptus*.

ANACRYPTUS SCULPTURATUS, new species.

Female.—Length 2.5 mm. Black, petiole, base of abdomen and lower margins of the segments brown; face punctured, the medial part finely transversely lineolated; antennæ brown, the scape yellow; back of head finely lineolated; thorax with large punctures, those on scutellum stronger; anterior part of mesopleuræ rugose, the posterior part very coarsely rugoso-punctate; wings slightly yellowish; anterior and middle legs, including coxæ, testaceous; hind coxæ black, tips reddish, hind femora and tibiæ reddish, the femora black medially; hind femora with about eight teeth following the large one; abdomen smooth, polished.

Male.—Length 2.5 mm. Similar to female except in sexual characters.

Manila, P. I. (R. E. Brown and W. A. Stanton, collectors.)

Type.—Cat. No. 12901, U.S.N.M.

Family EURYTOMIDÆ.

Tribe EURYTOMINI.

EURYTOMA FULVIPES, new species.

Female.—Length 2 mm. Black, head, including face below antennæ and thorax, umbilicately punctured; pubescence white; antennæ brown, the scape reddish-testaceous; joints of funicle almost quadrate, the first slightly longer than wide; prothorax about twice as wide as long; metathorax rugose, median groove with an indistinct double row of transverse pits; wings hyaline, nervures almost white; legs red, the coxæ black, tarsi whitish; petiole short; abdomen polished, the third segment much the longest, the fourth showing only slightly.

Male.—Length 2 mm. Similar to the female; scape and pedicel reddish-testaceous, flagellum brown; joints of the funicle excised above; legs reddish, coxæ black, tarsi whitish; petiole about as long as hind coxæ.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12902, U.S.N.M.

EURYTOMA BRUNNEIPENNIS, new species.

Female.—Length 3 mm. Black, closely, strongly umbilicately punctured, with yellowish pubescence; carinæ along inner orbits not high, but distinct, with a row of punctures between them and the eyes; face below antennæ with striæ converging toward mouth; antennal fossa strongly carinate at sides, these carinæ continued below to the mouth; antennæ long, dark, the scape testaceous except apical half above; first joint of funicle about as long as scape; following joints of funicle about twice as long as broad; prothorax about twice as wide as long; mesopleuræ weakly, irregularly rugose; metathorax coarsely, irregularly rugose, with a median longitudinal depression, but no differentiated area; wings strongly infuscated; coxæ black, trochanters, bases, and apices of femora and tibiæ and the tarsi reddish-testaceous, the hind tarsi more whitish; femora and tibiæ medially dark brown or black; petiole longer than hind coxæ, rugulose above; abdomen polished, segment 3 longer than 4.

Male.—Length 2.5 mm. Similar to female; antennæ longer, the joints of funicle more elongate, the first longer than the scape; scape at apex below with a projecting, rounded elevation; joints of funicle not excised above, and covered with hairs not arranged in whorls; petiole longer than in female.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12903, U.S.N.M.

EURYTOMA BROWNII, new species.

Female.—Length 2.5 mm. Black, head and thorax strongly umbilicately punctured; face below antennæ with striæ converging toward mouth; antennæ black, joints of funicle distinctly longer than wide, the first almost twice as long as wide and over one-half as long as scape; inner orbits with high carinæ running from just below lateral ocelli to the lower level of eyes; carinæ at sides of antennal fossa extended beneath, converging, to the mouth parts, the area between them smooth, shiny; carinæ at rear of cheeks running to vertex; pronotum about twice as wide as long; metathorax with posterior face distinctly separated from sides, irregularly rugose and finely roughened, the median groove distinguished by a row of transverse pits and by the non-roughened surface; wings hyaline, nervures light; legs black, knees, most of front tibiæ and apices of middle and hind tibiæ testaceous; tarsi more whitish; abdomen polished, greatly compressed, petiole short; third and fourth segments subequal in length, each about as long as segments 1 plus 2.

Male.—Length 2 mm. Similar to female; antennæ elongate, joints of funicle excised above, hair in whorls; petiole longer than hind coxæ.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12904, U.S.N.M.

Named for Father Brown.

EURYTOMA SYSTOLOIDES, new species.

Female.—Length 2.5 mm. Black, umbilicately punctured, pubescence white; face below antennæ with striæ converging toward mouth; no distinct carinæ along inner orbits; antennæ black, joints of funicle almost quadrate, the first slightly longer; pronotum about twice as wide as long; mesopleuræ finely sculptured with thimble-like punctures, at rear above with horizontal striæ and a row of large punctures; metathorax irregularly rugose, medially with a double row of transverse pits; wings milky hyaline, nervures light testaceous; legs black, knees, and extreme tips of tibiæ yellowish; tarsi whitish; petiole short; abdomen polished, segments 1–3 subequal in length, segment 3 slightly longer; segment 4 as long as segments 1–3 together.

Male.—Length 2 mm. Similar to female; antennæ longer, joints of funicle excised above at apex, hairs arranged in whorls; nervures almost white; petiole as long as hind coxæ.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12905, U.S.N.M.

EURYTOMA CARINATIFRONS, new species.

Female.—Length 2.5 mm. Black; head above antennæ and thorax strongly umbilicately punctured; face below antennæ with striæ converging toward mouth; face with a greatly elevated carina on each side running parallel to inner orbits, from just in front of lateral ocelli to below level of eyes; between these carinæ and the eyes impunctured; antennal fossa strongly carinate at sides; below the insertion of the antennæ these carinæ continue, converging toward the mouth, the space between them, smooth, shiny, and with a single vertical stria; carinæ on posterior edge of cheeks running to vertex; antennæ long, black, the scape short, reddish, the first joint of flagellum two-thirds the length of scape, following joints of funicle about twice as long as broad; pronotum twice as broad as long, wider anteriorly; metathorax irregularly rugose, with a median groove with transverse pits; wings greatly infuscated; legs black, femora pedunculate; trochanters, bases and tips of both femora and tibiæ reddish; tarsi whitish; abdomen greatly compressed, petiole as long as posterior coxæ; segment 3 longer than 4.

Male.—Length 2.5 mm. Similar to female; antennæ longer, first joint of flagellum as long as scape; joints of funicle not excised above, hairs not arranged in whorls; petiole longer than hind coxæ; legs red, hind femora medially black; occasionally front and middle legs with femora infuscated medially.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12906, U.S.N.M.

Family PTEROMALIDÆ.

Subfamily SPHEGIGASTERINÆ.

Tribe PACHYNEURONINI.

PACHYCREPIS ORIENTALIS, new species.

Female.—Length 1.75 mm. Bluish green, the abdomen more bluish and in certain lights bronzy; head and thorax with fine thimble-like punctures, those on the head coarser; antennæ yellowish, the funicle five-jointed, the antennæ with three ring joints so minute as to be distinguishable only under very high power; head slightly wider than thorax; prothorax anteriorly carinate, not rounded; parapsidal grooves very distinct; metathorax with a very distinct neck, between the lateral folds punctured; laterad of the lateral folds smooth; the spiracles long oval; anterior part of mesopleuræ punctured, the posterior part smooth and shiny; wings hyaline; the stigmal vein about as long as the marginal, the postmarginal longer; legs entirely testaceous; petiole slightly shorter than the hind coxæ; abdomen smooth, polished.

Male.—Length 1.5 mm. Similar to the female, the last ring joint large, the sculpture of the head and thorax stronger.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12907, U.S.N.M.

Family ELASMIDÆ.

ELASMUS ALBOPICTUS, new species.

Female.—Length 2.5 mm. Yellow with an orange tinge, the face below, tegulæ and legs, ivory white; head and thorax closely clothed with short black hairs, except on scutellum and postscutellum; antennæ brown, scape and pedicel yellow; ocellar area together with a median stripe running backward on rear of head, a triangular spot on upper posterior orbits connected with the median stripes, axillæ, scutellum except sides and rear, median and lateral spots on metathorax, a spot on mesopleuræ, and a spot on each side of first abdominal segment, black; apical part of scutellum and base of postscutellum, yellow; hind coxæ with a green spot above; bristles of legs black, those on rear of posterior tibiæ arranged in diamond shaped figures; abdomen with a few black bristles.

Male.—Unknown.

Manila, P. I. (R. E. Brown, collector.) One specimen.

Type.—Cat. No. 12908, U.S.N.M.

Family EULOPHIDÆ.

Subfamily EULOPHINÆ.

SYMPIESIS RUGITHORAX, new species.

Female.—Length 2 mm. Head and thorax dark green, abdomen at base blue, the apex black, the disk yellow; antennæ brown, the scape at base whitish; face smooth shiny; in front of ocelli reticulate; thorax strongly rugoso-punctate, the axillæ smooth; metathorax strongly rugose, with a median carina and on each side a lateral one running out onto the neck of the metathorax; mesopleuræ almost entirely smooth; wings slightly dusky; legs white; venter testaceous.

Manila, P. I. (R. E. Brown, collector.)

Type.—Cat. No. 12909, U.S.N.M.

NOTES ON A COLLECTION OF FISHES FROM CAMERON, LOUISIANA.

By FRANK WALTER WEYMOUTH,
Of Stanford University, California.

The collection upon which the following list is based was made for the Gulf Biologic Station, chiefly by Mr. Milo H. Spaulding during 1906. The station is located at Cameron, Louisiana, on the outlet of Calcasieu Lake, about 35 miles east of the Texas-Louisiana boundary, and most of the collecting was done in the vicinity, one of the chief localities being Calcasieu Pass, the mouth of the outlet upon which Cameron is situated. A few of the specimens were obtained at the Chandeleur Islands, nearly 40 miles northeast of the mouth of the Mississippi River and about 300 miles east of Calcasieu Pass, but unfortunately the labeling of the collection when it reached the writer's hands was so confused as to render impossible the exact recording of localities.

The most striking feature of the collection is a new species of the Cerdalidæ, the remaining members of which are known only from the Pacific coast of Central America. For this form it has been found necessary to erect a new genus, *Leptocerdale*, and the type-species is here described as *Leptocerdale longipinnis*.

The specimens are in a great part immature, a fact which has rendered identification in many cases very difficult. The extensive collections of Stanford University have been of great assistance in this difficulty, but even with the series at hand some of the young could not be identified.

The writer wishes to acknowledge his indebtedness to Prof. E. C. Starks, under whose direction the present work was done, and to Dr. Charles H. Gilbert and President David Starr Jordan for many helpful suggestions.

Family DASYATIDÆ.

1. *PTEROPLATEA MACLURA* (Le Sueur).

Represented in the collection by a single young specimen (total length, 190 mm.) which shows instead of the four distinct cross bands

on the tail mentioned in Jordan and Evermann's description^a only two with indications of a third basal band, which, however, fades into a dotted pattern like that of the disk. No caudal spine is present.

Family MYRIDÆ.

2. MYROPHIS PUNCTATUS Lütken.

Six specimens of this species are in the collection.

Family ELOPIDÆ

3. ELOPS SAURUS Linnaeus.

This widely distributed species is represented by one young specimen.

Family DOROSOMIDÆ.

4. DOROSOMA CEPEDIANUM (Le Sueur).

The two specimens in the collection would agree with the Gulf subspecies *exile*, if this is recognized, in the depth of the body, measuring 3 and 2½, respectively.

5. DOROSOMA MEXICANUM (Günther).

Represented by five specimens, which show the following variations: The anal rays number from 23 to 26 and the scutes behind the ventrals are more often 10 than 9 as given for the type.

Family CLUPEIDÆ.

6. CLUPANODON PSEUDOHISPANICUS (Poey).

One specimen.

7. BREVOORTIA TYRANNUS PATRONUS Goode.

Represented in the collection by ten adults and a considerable number of young, the latter rather doubtfully referred to this species.

Family ENGRAULIDÆ.

8. ANCHOVIA BROWNII (Gmelin).

Represented by four young specimens.

9. ANCHOVIA MITCHILLI (Cuvier and Valenciennes).

Represented by several specimens, some young, corresponding closely with specimens in the university collection and with Jordan and Evermann's description,^b but differing from the latter in following points: The head in specimens 3 inches long is smaller, 4 to 4½, instead of 3½, the depth usually greater, 3½ to 4, instead of 4, and the eye smaller, 3½ instead of 3.

^a Bull. 47, U. S. Nat. Mus., p. 87.

^b Idem, p. 446.

Family SYNODONTIDÆ.

10. *SYNODUS PECTENS* (Linnaeus).

There is in the collection one young specimen apparently of this species.

Family PÆCILIIDÆ.

11. *FUNDULUS SIMILIS* (Baird and Girard).

Two specimens were placed in this species. They might possibly fall in the closely allied *F. majalis*, but the vertical scale count of 11 instead of 13 does not favor this.

12. *FUNDULUS HETEROCLITUS* (Linnaeus).

This species is represented by a number of specimens. From the range these might be the subspecies *F. heteroclitus grandis*,^a but they show no sharply marked differences from the typical forms.

13. *CYPRINODON VARIEGATUS* Lacépède.

This species is represented by six specimens.

14. *MOLLIENISIA LATIPINNA* Le Sueur.

There are three specimens in the collection belonging to this species.

Family ESOCIDÆ.

15. *TYLOSURUS MARINUS* (Walbaum).

There is one immature specimen in the collection apparently belonging to this species.

Family SYNGNATHIDÆ.

16. *SYNGNATHUS FLORIDÆ* (Jordan and Gilbert).

This species is represented by one specimen.

17. *SYNGNATHUS SCOVELLI* (Evermann and Kendall).

Represented in the collection by five specimens.

18. *SYNGNATHUS LOUISIANÆ* Günther.

Represented by one adult and several young.

19. *SYNGNATHUS CRINIGERUM* (Bean and Dressel).

This species is represented by numerous specimens.

20. *HIPPOCAMPUS ZOSTERÆ* Jordan and Gilbert.

This diminutive sea horse, reported by Jordan and Evermann^b only from the type locality, Pensacola Bay, is represented by five specimens.

^a Jordan and Evermann, Bull. 47, U. S. Nat. Mus., p. 641.

^b Idem, p. 778.

Family ATHERINIDÆ.

21. *KIRTLANDIA VAGRANS* (Goode and Bean).

There are in the collection seven specimens agreeing well with this species but apparently not sharply separated from the northern subspecies, *laciniata*.

Family MUGILIDÆ.

22. *MUGIL CEPHALUS* Linnaeus.

There are four adults of this species in the collection.

Family POLYNEMIDÆ.

23. *POLYDACTYLUS OCTONEMUS* (Girard).

Represented in the collection by six specimens.

Family TRICHIURIDÆ.

24. *TRICHIURUS LEPTURUS* Linnaeus.

This species is represented by two specimens.

Family CARANGIDÆ.

25. *OLIGOPLITES SAURUS* (Bloch and Schneider).

Represented by four immature specimens.

26. *CARANX HIPPOS* (Linnaeus).

This widely distributed species is represented by a single specimen.

27. *CARANX LATUS* Agassiz.

Represented by four young specimens showing five or six vertical stripes.

28. *VOMER SETIPINNIS* (Mitchill).

This species is represented by three immature specimens.

29. *CHLOROSCOMBRUS CHRYSURUS* (Linnaeus).

Represented by two young.

30. *TRACHINOTUS CAROLINUS* (Linnaeus).

This species is represented by two immature specimens.

Family POMATOMIDÆ.

31. *POMATOMUS SALTATRIX* (Linnaeus).

Represented by three young specimens.

Family STROMATEIDÆ.

32. RHOMBUS PARU (Linnaeus).

This species is represented by six small specimens.

Family LOBOTIDÆ.

33. LOBOTES SURINAMENSIS (Bloch).

Represented by a single immature specimen.

Family SPARIDÆ.

34. LAGODON RHOMBOIDES (Linnaeus).

There are two specimens of this species in the collection.

Family SCLÆNIDÆ.

35. BAIRDIELLA CHRYSURA (Lacépède).

This common species is represented by two specimens.

36. STELLIFER LANCEOLATUS (Holbrook).

There are in the collection six specimens agreeing well with Jordan and Evermann's description ^a of this species except that the scale count is 43 to 44 instead of 47 to 50.

37. LEIOSTOMUS XANTHURUS Lacépède.

Represented by fifteen immature specimens.

38. MICROPOGON UNDULATUS (Linnaeus).

There are in the collection a considerable number of very immature specimens apparently agreeing with this species in barbels and fin-ray count.

39. MENTICIRRUS SAXATILIS (Bloch and Schneider).

There are three young specimens doubtfully placed here and possibly belonging either to *M. americanus* or *M. littoralis*. They appear, however, to have larger teeth than *littoralis*, and to display the coloration of *saxatilis* (stripes, dark tip to spinous dorsal and to anal) rather than of *americanus*.

Family MONACANTHIDÆ.

40. MONACANTHUS CILIATUS (Mitchill).

Represented by a single young specimen.

41. MONACANTHUS HISPIDUS (Linnaeus).

A single young specimen of this species.

^a Bull. 47, U. S. Nat. Mus., p. 1443.

42. *ALUTERA PUNCTATA* Agassiz.

Represented by two young specimens. These might possibly fall in *A. schoepfi*, but the presence of minute spots, unless an immature character, favor *punctata*.

Family TETRAODONTIDÆ.

43. *SPHEROIDES TESTUDINEUS* (Linnaeus).

This species is represented by two immature specimens.

Family TRIGLIDÆ.

44. *PRIONOTUS PUNCTATUS* (Bloch).

Represented by one young specimen. This record is a material increase of range, for, although reported from the West Indies (Jamaica) and the Caribbean Sea, it has not before been taken on the coasts of the United States.

45. *PRIONOTUS TRIBULUS* (Cuvier).

This species is represented by two immature specimens.

Family GOBIIDÆ.

46. *CTENO GOBIUS BOLEOSOMA* (Jordan and Gilbert).

There are in the collection several young specimens probably of this species, at least closely agreeing with young in the Stanford University collection. Some of the specimens here included may belong to *C. schufeldti* or *fasciatus*, but in the absence of more material for comparison this can not be satisfactorily determined.

47. *GOBIOSOMA MOLESTUM* Girard.

Represented by fifteen specimens, some very young.

48. *GOBIOSOMA BOSCI* (Lacépède).

This species is represented by one specimen.

49. *GOBIOIDES BROUSSONNETII* Lacépède.

Represented by one specimen.

Family URANOSCOPIDÆ.

50. *ASTROSCOPUS Y-GRÆCUM* (Cuvier and Valenciennes).

This species is represented by one young specimen.

51. *ASTROSCOPUS GUTTATUS* Abbott.

A single young specimen. This is a considerable increase of range, as the southernmost record at hand is Norfolk, Virginia.^a

^a Bean, Proc. U. S. Nat. Mus., 1879, p. 60.

Family BATRACHOIDIDÆ.

52. OPSANUS TAU (Linnaeus).

Represented by numerous specimens.

Family GOBIESOCIDÆ.

53. GOBIESOX VIRGATULUS Jordan and Gilbert.

This species is represented by two specimens.

Family BLENNIIDÆ.

54. HYPLEUROCHILUS GEMINATUS (Wood).

This species is represented by two specimens, a male (*multifilis*) with a supraorbital cirrus equal in length to twice the diameter of the eye, and the anal II, 17 instead of II, 18,^a and a female (*geminatus*) with a supraorbital cirrus shorter than the eye, and 16 rays in the anal, which is apparently without spines.

55. HYPSOBLENNIUS IONTHAS (Jordan and Gilbert).

There are three specimens of this species in the collection, two males and a female. The males have the long supraorbital cirrus and otherwise correspond very closely to Jordan and Evermann's description^b, but have D. XII, 14, A. II, 14 and 16 instead of D. XII, 14 or 15, A. II, 15 or 16. The female does not agree so closely, having no evident cirrus, while the dorsal is XII, 14 and the anal I 15 (possibly II, 14) instead of D. XII, 13 or 14, A. II, 13 or 14.

56. HYPSOBLENNIUS HENTZ (Le Sueur).

There are two specimens of this species in the collection. The male, which corresponds very closely to the description given by Jordan and Evermann^c, having the dorsal XII, 14 and the anal II, 15 instead of D. XII, 15, A. 18, is quite evidently Wood's *Blennius punctatus*,^d as he mentions the bifurcated orbital cirrus. The female agrees with Le Sueur's original description of *Blennius hentz*, where the cirrus is spoken of as short and presumably simple and the fin ray formula given as D. XI, 14, A. 16, which is nearer that of the female at hand (D. XII, 14, A. I?, 15) than that of the male. In other words, the discrepancies between the two descriptions given by Jordan and Evermann are the differences between the male and female, analogous to those found in *Hypsoblennius ionthas*, the description in the text and that given by Wood referring to the male, and that of Le Sueur referring to the female.

^a Jordan and Evermann, Bull. 47, U. S. Nat. Mus., p. 2385.

^b Idem, p. 2388.

^c Idem, p. 2390.

^d Journ. Acad. Nat. Sci. Phila., vol. 4, 1825, p. 279.

57. *CHASMODES SABURRÆ* Jordan and Gilbert.

Represented by nine specimens. The males show the modification of the two anterior anal spines mentioned by Jordan and Evermann.

58. *CHASMODES BOSQUIANUS* (Lacépède).

This species is represented by one specimen.

Family CERDALIDÆ.

LEPTOCERDALE, new genus.

Body extremely elongate, with small non-imbricate rudimentary scales; head small; snout short and obtuse; lower jaw obtuse, much projecting; mouth markedly oblique; teeth minute, found only in jaws; eye very small; gill slit moderately narrow, more nearly vertical than horizontal; vertical fins joined to caudal; pectorals moderate; ventrals small, of one minute spine and three rays; vent normal, a trifle anterior to the middle of the body.

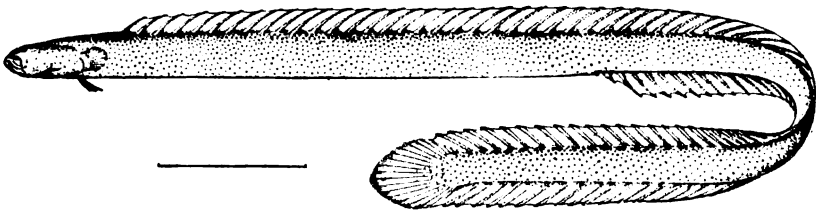


FIG. 1.—*LEPTOCERDALE LONGIPINNIS*.

This genus is separated from *Cerdale* and *Microdesmus*, the other genera of the Cerdalidæ, chiefly by its much more elongate form and the larger size of the gill slits. In *Cerdale* (*C. ionthas*) the gill slit is shorter than the base of the pectoral and runs very nearly horizontally forward from the lower edge of the base of the pectoral; in *Microdesmus* (*M. retropinnis*) the gill slit is about as long as the base of the pectoral and runs obliquely forward and downward from the middle of the pectoral base, while in the present genus the gill slit is wider than the base of the pectoral and runs from near its upper edge downward and slightly forward. The depth in *Cerdale* is $10\frac{1}{4}$ and in *Microdesmus* $15\frac{1}{4}$ (*M. retropinnis*) and 18 (*M. dipus*) while in the present genus is much more slender than either, the depth varying from 24 to 33.

Type of the genus.—*Leptocerdale longipinnis*.

59. *LEPTOCERDALE LONGIPINNIS*, new species.

Head 15 in body length (tip of snout to base of caudal), depth 30 in length, D. 68, A. 42, P. 14, V. I, 3.

Body greatly elongate, compressed, and tapering but slightly. Vertebrae (determined from one of the cotypes) 62 and the hypural

plate, of which 29 are anterior to the vent. Head small, blunt; mouth moderately small, markedly oblique; lower jaw markedly projecting and blunt, gape not reaching vertical from front of orbit; teeth (determined from one of the cotypes) only in jaws, minute, acute, arranged both above and below in two rows which, however, are approximated and tend to pass into one at the extreme posterior end. Nostril double, anterior opening at tip of upper jaw, posterior at anterior edge of orbit. The cheeks are provided with rows of extremely minute pores having a definite arrangement. There are three principal vertical rows dividing the space between the angle of the mouth and the tip of opercle into four approximately equal spaces. The most posterior of these is deflected forward below and joins the

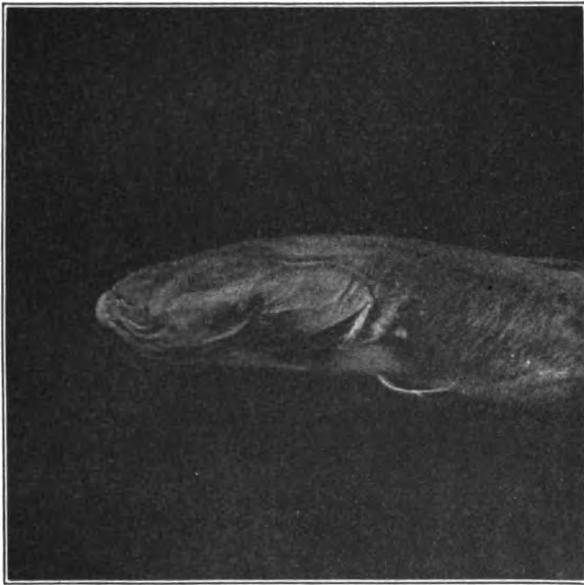


FIG. 2.—HEAD OF LEPTOCERDALE LONGIPINNIS.

next anterior near its lower end. In addition there are three much shorter vertical lines running downward from near the eye and just failing to join a rather longer horizontal line lying at the level of the gape. No pores were noticed in other parts of the head. The other available members of the family (*Cerdale ionthas* and *Microdesmus retropinnis*) were examined in this connection and found to exhibit similar pores, but rather less conspicuous and differing in arrangement. Gill slit wider than attachment of pectoral (4 in head), running from near the upper margin of base of pectoral downward and slightly forward, somewhat curved.

The vertical fins are connected with the caudal. The distance from the head to the origin of dorsal is contained about twice in head. The dorsal is composed of 21 slender flexible spines and 47 branched

articulate rays, separable, however, only under a lens. Origin of anal slightly nearer tip of snout than base of caudal. Anal composed entirely of branched articulate rays. Caudal well developed, broadly rounded (in some of the cotypes showing a tendency to become more or less pointed). Pectorals well developed, rounded; ventral small, inserted close together about under insertion of pectoral, of three distinct rays, the inner much the longer, and a minute spine. The spine is difficult to distinguish in some of the specimens at hand, but is plainly present in a number, thus agreeing in this feature with the other members of the family as determined by Gilbert and Starks.^a

Scales small, round, nonimbricate, and widely separated; extending, somewhat reduced in size, over the entire head. The scales are almost entirely missing in the type, the point of attachment being marked by a small depression, but are present in several of the cotypes.

Color in life unknown; no markings present in the type, but in part of the other specimens, due apparently to difference in preservation, there remain exceedingly minute dark fleckings along the dorsal surface, extending in some cases over a considerable portion of the dorsal fin.

Type.—Cat. No. 64157, U.S.N.M., 210 mm. long. This together with the cotypes were taken with a jack-light at night, a fact which may explain why they have not been previously obtained.

The cotypes, 11 in number, show some variations not noted in the foregoing description. The following table will exhibit the chief of these.

Head in total length.	Depth in total length.	Dorsal rays.	Anal rays.
16½	25	67	42
16½	26	70	48
17½	33½	71	46
17	27½	69	43
14	29	68	41
14½	27	71	43
14½	28	70	42
16	28½	70	45
14	24½	66	42
14	26½	68	43
14	27	67	42

Part of the cotypes are deposited in the Stanford University collection, part in the U. S. National Museum.

Family PLEURONECTIDÆ.

60. *ETROPUS CROSSOTUS* Jordan and Gilbert.

There are five specimens apparently belonging to this species, though the interorbital space is distinctly scaly while it is said to be bare in the generic description of *Etropus*.

^a Fishes of Panama, p. 196.

Family SOLEIDÆ.

61. *ACHIRUS FASCIATUS* Lacépède.

Represented by three specimens.

62. *SYMPHURUS PLAGIUSA* (Linnaeus).

There are twelve specimens of various sizes which by the number of dorsal fin rays (about 90) appear to belong to this species rather than the closely allied *S. pusillus*, said to have D. 78.

Family ANTENNARIIDÆ.

63. *PTEROPHYRNE GIBBA* (Mitchill).

The single specimen of this genus appears to belong to this species, the bait being bulbous rather than bifurcate. From specimens available for comparison, however, this character shows a considerable variation, and as this is the chief specific distinction, the form may prove not to be separable from *P. histrio* (Linnæus).

Proc.N.M.vol38—10—10

REPORT ON A COLLECTION OF BIRDS MADE BY PIERRE LOUIS JOUY IN KOREA.

By AUSTIN H. CLARK,

Assistant Curator, Division of Marine Invertebrates, U. S. National Museum.

The late Mr. Pierre Louis Jouy, during a residence of over three years in Korea within the period from 1881 to 1886, brought together a magnificent collection of the birds of that country, his specimens, five hundred and fifty-four in number, having been taken mainly at Fusan, Chemulpo, and Seoul, though a few are from Gensan. He also visited the island of Tsushima in the Korean Straits, and obtained a very interesting series of the birds of that locality. This collection, much the most important ever made in Korea, has never been reported upon. Mr. Jouy was engaged in work upon it at the time of his death, and subsequently Dr. Leonhard Stejneger made use of some of the material in his studies on the avifauna of Japan. Although he published comparatively little upon it, he went over the collection carefully and identified most of the species. It was suggested that, as I had spent considerable time in the vicinity of the Korean coast, an account of Mr. Jouy's specimens could appropriately be prepared along with the account of my own observations, and I therefore spent considerable time in the study of his material. This was, in the main, chiefly a review of the work already done by Mr. Jouy and Doctor Stejneger, and a confirmation of the results already attained by them.

A preliminary notice of the new forms which I detected among the material studied was published in these Proceedings, vol. 32, pp. 467-475.

While this preliminary notice was in press a paper appeared written by that eminent authority on Asiatic birds, Mr. Sergius A. Buturlin, of Wesenberg, Esthonia, in which certain of my new forms were anticipated. Mr. Buturlin has had the kindness to assist me in straightening out the matter, and he has recently published a note by which the confusion caused has been dispelled. I entirely agree

with Mr. Buturlin in his conclusions, which are reviewed in detail in the discussion of the birds involved, species of the genus *Dendrodromas*.

Owing to the press of work connected with animals other than birds, I have been unable to devote as much time to the preparation of this paper as the importance of the collection merited; but I have thought it better to present it in its present form than to retain it longer in the hope of perfecting it, for it is advisable, in justice to Mr. Jouy, that the sum of the results of his labors in Korea be given to the world as soon as possible, before the somewhat large number of birds, first actually obtained in that country by him, but first recorded by others, is further increased.

In addition to Mr. Jouy's birds I have included notices of some interesting specimens obtained in southwestern Korea by Dr. William Lord Smith, of Boston, during November and December, 1902, and January, 1903. Doctor Smith started from Mak-Po (in about lat. 35° N.) and went down the west coast, partly by junk and partly on foot, to the end of the peninsula. He was the first to make collections in this part of the country.

The classification herein followed is that of the American Ornithologists' Union check list, which has been adopted so that comparison between this paper and my report on the birds collected and observed during the cruise of the U. S. Fisheries steamer *Albatross* may be facilitated.

Order PYGOPODES.

Suborder PODICIPEDES.

Family PODICIPIDÆ.

COLYMBUS NIGRICOLLIS (Brehm).

RARED GREBE.

There are three specimens of this species in Mr. Jouy's collection, two males from Fusan, taken on December 7, 1884, and on December 10, 1883, and one example in winter plumage, unsexed, and with no locality given but "Korea."

Suborder CEPPHI.

Family GAVIIDÆ.

GAVIA STELLATA (Pontoppidan).

RED-THOATED LOON.

There are in Mr. Jouy's collection two males from Fusan, obtained on March 8, 1885.

Family **ALCIDÆ**.Subfamily **ÆTHIINÆ**.**SYNTHLIBORAMPHUS WUMIZUSUME** (Temminck).**JAPANESE MURRELET**.

There are two males of this interesting species in Mr. Jouy's collection from Fusan, taken on April 20, 1884.

Order **LONGIPENNES**.Family **LARIDÆ**.Subfamily **LARINÆ**.**LARUS CRASSIROSTRIS** Vieillot.**JAPANESE BAND-TAILED GULL**.

There is an immature specimen of this species in the collection labeled "Fusan" with no further data.

Subfamily **STERNINÆ**.**STERNA SINENSIS** Gmelin.**ORIENTAL LESSER TERN**.

There is an adult male in Mr. Jouy's collection, taken on the Salu River, at Seoul, on June 25, 1883.

Order **TUBINARES**.Family **DIOMEDEIDÆ**.Subfamily **DIOMEDEINÆ**.**DIOMEDEA ALBATRUS** Pallas.**SHORT-TAILED ALBATROSS**.

In the Korean collection there is a specimen without data in regard to sex and exact locality. Mr. Jouy obtained another, a male, at Tsushima, in the Korean Straits, on June 2, 1885.

Subfamily **PUFFININÆ**.**PUFFINUS LEUCOMELAS** Temminck.**TEMMINCK'S SHEARWATER**.

Mr. Jouy obtained a male of this species at Fusan, on May 18, 1884.

Order **STEGANOPODES**.Family **PHALACROCORACIDÆ**.**PHALACROCORAX FILAMENTOSUS** Temminck and Schlegel.**TEMMINCK'S CORMORANT**.

There are two specimens of this bird, both males in juvenile plumage, in the Korean collection, one taken at Seoul in July, and the other at Chemulpo in August.

Order ANSERES.**Family ANATIDÆ.****Subfamily ANATINÆ.****ANAS ZONORHYNCHA Swinhoe.****DUSKY MALLARD.**

There is a specimen of this duck in the National Museum collection which was taken in southwestern Korea by Dr. William Lord Smith.

NETTION CRECCA (Linnaeus).**TEAL.**

There is in Mr. Jouy's collection a male of this species from Fusan, taken on January 23, 1886.

NETTION FORMOSUM (Georgi).**SPECTACLED TEAL.**

Mr. Jouy's Korean collection contains a male from Fusan, taken on January 24, 1886, and a female from the same locality, taken on the 18th of the same month.

EUNETTA FALCATA (Georgi).**FALCATED TEAL.**

In the collection made by Mr. Jouy there are three males of this beautiful species, one taken on the Naktung River, at Fusan, on December 10, 1884, the others labeled "Korea," with no further particulars.

CASARCA FERRUGINEA (Pallas).**BUDDY SHELDRAKE.**

There are two of these ducks from Korea in the National Museum collection, one, an adult female, collected by Mr. Jouy, without any particulars as to capture, the other, unsexed, taken by Dr. W. L. Smith in the southwestern part of the country.

Subfamily FULIGULINÆ.**CLANGULA CLANGULA CLANGULA (Linnaeus).****GOLDEN-EYE.**

Mr. Jouy obtained a young male of this species at Fusan on December 8, 1883.

HISTRIONICUS HISTRIONICUS (Linnaeus).**HARLEQUIN DUCK.**

Two adult males were secured by Mr. Jouy, one in Fusan Bay on March 14, 1886, the other at Deer Island, near Fusan, on December 14, 1884.

Subfamily **ANSERINÆ**.**ANSER ALBIFRONS GAMBELLI** (Hartlaub).**AMERICAN WHITE-FRONTED GOOSE.**

Mr. Jouy's collection contains four specimens of this subspecies, two males collected at Fusan on March 13, 1885, and a third male, taken by Mr. Jouy between Seoul and Fusan on November 12, 1883. There is another Korean specimen in the National Museum collection, unsexed and undated, collected in the southwestern part of the country by Dr. W. L. Smith. All three are typical examples of the race.

Specimens of White-fronted Geese from Shanghai in the National Museum collection, however, are unmistakably *A. albifrons albifrons*.

OLOR CYGNUS (Linnaeus).**WHOOPEE SWAN.**

There is a specimen of this bird from southwestern Korea in the National Museum collection, which was taken by Dr. W. L. Smith.

Order **HERODIONES**.Suborder **IBIDES**.Family **IBIDIDÆ**.**NIPPONIA NIPPON** (Temminck).**JAPANESE CRESTED IBIS. TOKI.**

There is an adult male of this species in the collection taken by Mr. Jouy on December 17, 1883, at Fusan.

Family **PLATALEIDÆ**.**PLATALEA MINOR** Temminck and Schlegel.**SWINHOE'S BLACK-FACED SPOONBILL.**

The collection includes a young male of this species taken at Fusan on December 7, 1884.

Suborder **CICONIÆ**.Family **CICONIIDÆ**.Subfamily **CICONIINÆ**.**CICONIA BOYCIANA** Swinhoe.**JAPANESE STORK. KO-DZURU.**

Mr. Jouy's collection contains two adult males of this species collected on December 3 and 15, 1883, at Fusan, and a female taken at the same place on December 21 of the same year.

Suborder HERODII.

Family ARDEIDÆ.

Subfamily ARDEINÆ.

ARDEA CINEREA JOUYI Clark.

ORIENTAL GRAY HERON. AWO-SAGI.

Ardea cinerea jouyi A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 468 (Seoul, Korea).

Mr. Jouy collected three specimens of this form at Seoul on July 4, 1883, an adult male, an adult female, and a young male. These were compared with a good series from eastern and central China and from Japan, and found to be the same.

HERODIAS EULOPHOTES Swinhoe.

A male of this species was secured at Fusan, Korea, on April 25, 1886, by Mr. Jouy.

DEMIGRETTA RINGERI Stejneger.

RINGER'S REEF HERON. KURO-SAGI.

There are two males and four females of this species in Mr. Jouy's collection, taken at Tsushima on May 26, 1885.

Order PALUDICOLÆ.

Suborder GRUES.

Family GRUIDÆ.

GRUS MONACHUS Temminck.

WHITE-HEADED CRANE.

There are two males of this species in Mr. Jouy's collection taken at Fusan on December 11, 1883. In these specimens the head is entirely feathered, the fore part of the head being chiefly white with occasional black feathers, and the hind neck and nape washed with rufous.

PSEUDOGERANUS LEUCAUCHEN (Temminck).

WHITE-NEPED CRANE.

A female taken by Mr. Jouy at Fusan on December 6, 1883, has the head entirely feathered, gray (including the throat) suffused with rusty, especially on the crown, where the feathers are rusty with gray tips, becoming clear rusty on the hind neck; lower down there is a sprinkling of white feathers, becoming more frequent until on the lower neck the color is white with occasional rusty spots. Mr. Jouy also obtained a male of this species at Fusan on January 8, 1884, and a third specimen with which there are no data.

Suborder RALLI.

Family RALLIDÆ.

GALLICREX CINEREUS (Gmelin).

WATER-COOCK.

Mr. Jouy collected an adult male of this species at Fusan on June 28, 1885.

Order LIMICOLÆ.

Family SCOLOPACIDÆ.

SCOLOPAX RUSTICOLA Linnaeus.

WOODCOCK.

In the collection from Korea there is a pair of wings from a specimen of this species obtained by Mr. Jouy, with no data attached.

GALLINAGO GALLINAGO UNICLAVUS Hodgson.

EASTERN SNIPE. KULIK.

There are two females of this species in Mr. Jouy's Korean collection, both from Seoul, taken on September 28, 1883.

GALLINAGO SOLITARIA Hodgson.

JAPANESE SOLITARY SNIPE.

The Korean collection includes a female of this bird taken at Fusan on November 18, 1884.

GALLINAGO MEGALA Swinhoe.

SWINHOE'S SNIPE.

A male from Seoul shot on August 24, 1883, is in Mr. Jouy's collection.

GALLINAGO STENURA (Bonaparte).

PINTAIL SNIPE.

Among Mr. Jouy's birds are two males of this species, one taken at Seoul on September 23, 1883, and one at Chemulpo on September 8, 1883, and a female taken in August at Seoul.

PELIDNA ALPINA SAKHALINA (Vieillot).

RED-BACKED SANDPIPER.

Mr. Jouy's collection includes five birds of this subspecies, a male from Chemulpo taken on May 28, 1883, two males from Seoul taken on October 7, 1883, a female from Seoul taken on the same date, and a female from the Naktung River at Fusan, taken October 26, 1884.

LIMOSA LAPPONICA BAUERI (Naumann).**PACIFIC GODWIT.**

In the collection are a pair of these birds from the Naktung River at Fusan, taken on October 25 and November 8, 1885, and two males and a female from Chemulpo taken on September 6, 1883. There is also another specimen without data.

TOTANUS NEBULARIUS GLOTTOIDES (Vigors).**EASTERN GREEN-SHANK.**

This species is represented in the collection by a pair from Chemulpo taken on September 6 and 20, 1883.

HELODROMAS OCHROPUS (Linnaeus).**GREEN SANDPIPER.**

A pair from Seoul secured on October 7, 1883, is in Mr. Jouy's collection.

HETERACTITIS BREVIPIES (Vieillot).**ORIENTAL TATTLER.**

The collection includes a pair of this species from Tsushima taken on May 29, 1885, and a female from Fusan taken on May 9, 1886.

ACTITIS HYPOLEUCOS (Linnaeus).**COMMON SANDPIPER.**

In Mr. Jouy's collection there is a male of this species collected on September 4, 1883.

NUMENIUS ARQUATUS LINEATUS (Cuvier).**ORIENTAL CURLEW.**

A male secured at Chemulpo on September 4, 1883, and two females from the Naktung River at Fusan, taken on November 2, 1884, are in the collection.

NUMENIUS CYANOPUS Vieillot.**AUSTRALIAN CURLEW.**

Mr. Jouy secured two males of this species at Chemulpo, Korea, on September 8 and 11, 1883.

Family CHARADRIIDÆ.**CHARADRIUS DOMINICUS FULVUS (Gmelin).****PACIFIC GOLDEN PLOVER.**

This species is represented in the collection by a female taken at Seoul on September 23, 1883.

ÆGIALITIS DUBIA (Scopoli).**LITTLE RING PLOVER.**

There are in Mr. Jouy's collection three males of this species from Seoul, taken on June 25, 1883 and on September 18, 1883, a female from Gensan obtained on July 25, 1883, and two females from Seoul, one collected on June 25 and the other on September 18, 1883; there are also two females from Fusan, taken on December 25, 1884, and two specimens without data.

ÆGIALITIS PLACIDA Gray.**HODGSON'S RINGED PLOVER.**

A male taken at Seoul October 7, 1883, represents this species in the collection.

ÆGIALITIS MONGOLA (Pallas).**MONGOLIAN PLOVER.**

There is an unsexed and undated bird of this species from Gensan among Mr. Jouy's Korean skins.

Family HÆMATOPODIDÆ.**HÆMATOPUS OSCULANS** Swinhoe.**JAPANESE OYSTERCATCHER. PETUSCHÓK TACHAICAN.**

The collection contains a pair of these birds from Chemulpo collected on September 6, 1883, and a female from the Naktung River, near Fusan, taken on November 8, 1885.

Family LOBIVANELLIDÆ.**MICROSARCOPS CINEREUS** (Blyth).**GRAY-HEADED WATTLED LAPWING.**

There is a male of this species, taken at Fusan, on the Naktung River, April 19, 1884, in Mr. Jouy's collection.

Order GALLINÆ.**Suborder PHASIANI.****Family PHASIANIDÆ.****Subfamily PHASIANINÆ.****PHASIANUS KARPOWI KARPOWI** Buturlin.**KOREAN PHEASANT.**

The National Museum collection contains twelve specimens of this fine pheasant, three males from Fusan, taken by Mr. Jouy on January 12, 1885, and on December 5, 1883; one female from Fusan, taken on November 22, 1885; and eight males from southwestern Korea, taken by Doctor Smith.

PHASIANUS KARPOWI BUTURLINI Clark.**TSUSHIMA PHEASANT.**

Phasianus karpowi buturlini A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 468.

There is a male of this subspecies, the type, in the National Museum collection, which was taken by Mr. Jouy on Tsushima on May 21, 1885.

Subfamily COTURNICINÆ.**COTURNIX COTURNIX JAPONICUS (Temminck and Schlegel).****JAPANESE QUAIL.**

Mr. Jouy's collection contains two males of this form, one taken at Fusan November 21, 1885, and the other 40 miles from Seoul, November 11, 1883.

Family OTIDÆ.**OTIS DYBOWSKII Taczanowski.****EASTERN GREAT BUSTARD.**

The Korean collection contains three adult females of this species from Fusan, taken on December 16 and 24, 1883, and on January 6, 1884; an adult male taken on January 10, 1884, at the same place; and a fifth specimen from Fusan, the sex and date being unrecorded.

Order COLUMBÆ.**Family COLUMBIDÆ.****COLUMBA TACZANOWSKII Stejneger.****TACZANOWSKI'S PIGEON.**

The type of this species, an adult male, taken in southern Korea November 22, 1882, is in Mr. Jouy's collection.

TURTUR GELASTIS (Temminck).**EASTERN TURTLE DOVE. KJIJI-BATO.**

There are five specimens of this dove in the collection, three males and two females, taken at Seoul on June 14 and 15, and on August 6 and 26, 1883.

TURTUR DECAOCTA TORQUATUS (Bogdanow).**RINGED TURTLE DOVE. SHIRAKO-BATO. DEUDZUKAKEBATO.**

The collection contains three males of this species, taken on June 17, 1883, and on September 21 and 23 of the same year.

Order RAPTORES.**Suborder VULTURES.****Family VULTURIDÆ.****VULTUR MONACHUS Linnaeus.****ARABIAN VULTURE.**

Mr. Jouy's collection contains the tail of a bird of this species which was secured in Korea.

Suborder FALCONES.

Family FALCONIDÆ.

Subfamily BUTEONINÆ.

MILVUS ATER MELANOTIS (Temminck and Schlegel).**SIBERIAN BLACK KITE.**

In the collection there are six specimens of this common kite, a male from Seoul, taken on June 19, 1883, and two males and three females from Fusan, taken on April 13 and 30, 1884.

BUTEO HEMILASIUS Temminck and Schlegel.**SIBERIAN BUZZARD.**

In Mr. Jouy's collection there are a male of this species taken at Fusan January 7, 1884, and two females taken at the same place on February 18 and on March 3 of the same year. They agree perfectly with specimens from China.

BUTEO BUTEO JAPONENSIS (Gmelin).**JAPANESE BUZZARD.**

There is a female of this species in the Korean collection, taken at Fusan on February 18, 1884.

The [*Falco japonensis*] of Gmelin^a is based on the "Japanese Hawk" of Latham,^b the description of which applies to this form.

CIRCUS CYANEUS (Linnaeus).**HEN HARRIER.**

There are four specimens of this bird in Mr. Jouy's collection, all adult males, taken at Fusan on January 3, 1886, January 30, 1884, and on February 2, 1886.

ACCIPITER NISUS (Linnaeus).**EUROPEAN SPARROW HAWK.**

Mr. Jouy's collection contains six examples of this species, a male and a female taken between Seoul and Fusan on November 17 and 20, 1883; two males taken at Deer Island, near Fusan, November 30, 1884; and a male taken at Fusan December 14, 1883.

TACHYSPIZA SOLOENSIS (Latham).**SULU FALCON.**

The collection contains a male and two immature females of this species, secured at Seoul on August 24 and 26, 1883.

^aSyst. Nat., vol. 1, pt. 1, 1788, p. 257. ^bSynopsis, vol. 1, pt. 1, 1781, p. 33.

HALIAETUS ALBICILLA BROOKSI (Hume).**EASTERN GRAY SEA EAGLE.**

In the collection there are a young female of this form, taken at Fusan in November, 1884, and another specimen without data.

Family FALCONIDÆ.**FALCO PEREGRINUS ANATUM (Bonaparte).****DUCK HAWK.**

A female Peregrine Falcon taken by Mr. Jouy at Fusan on August 28, 1884, appears to be indistinguishable from typical specimens of this subspecies.

FALCO ÆSALON INSIGNIS (Clark).**KOREAN MERLIN.**

Æsalon regulus insignis A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 470 (Fusan, Korea).

The type of this subspecies, a young male, was obtained by Mr. Jouy at Fusan on March 12, 1884.

FALCO ÆSALON Tunstall.**MERLIN.**

There is a female unmistakably referable to this form in the collection, taken by Mr. Jouy at Fusan on November 23, 1884. It agrees perfectly with a good series of birds from Yezo.

It will be noticed that this is a winter bird, which probably came from northern Japan. Although the available material is very scanty, I believe that the breeding merlins of Korea will prove to be *F. æ. insignis*, while *F. æ. japonicus* will be found to be a winter visitor, at least to that part of the peninsula about the Korean Straits.

FALCO TINNUNCULUS PERPALLIDUS (Clark).**KOREAN KESTREL.**

Cerchneis perpallida A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 470 (Fusan, Korea).

The collection contains the type of this subspecies, a male, which was taken at Fusan on April 6, 1884.

FALCO TINNUNCULUS Linnaeus.**KESTREL.**

A female kestrel taken at Seoul, September 23, 1883, is referable to this subspecies. It is very dark in color, agreeing perfectly with specimens from Japan. Probably, as in the case of the merlins, the breeding kestrels in Korea will be found to belong to the light form which I have called *perpallidus*, while the dark Japanese form occurs during the migrations and possibly in winter.

Family PANDIONIDÆ.

PANDION HALIAETUS (Linnæus), subspecies.

OSPREY.

There is a male in the National Museum collection taken by Mr. Jouy at Tsushima on May 29, 1885.

Order STRIGES.

Family STRIGIDÆ.

ASIO OTUS (Linnæus).

EUROPEAN LONG-EARED OWL.

Mr. Jouy's collection includes three males of this species, one taken at Fusan on December 5, 1883, and two taken at Deer Island, near Fusan, on December 13 of the same year. They appear to be identical with specimens from Europe. These examples are rather light in color; but a bird from Havre, France, matches them exactly. A specimen from Hakodate and two from China in the National Museum collection are very dark; but another from Hakodate and one from China exactly resemble the Korean and European birds.

ASIO FLAMMEUS (Pontoppidan).

SHORT-EARED OWL.

There is in Mr. Jouy's collection an unsexed specimen of this species taken at Fusan on November 23, 1884.

STRIX MA (Clark).

KOREAN BROWN OWL.

Syrnium ma A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1890, p. 471 (Fusan, Korea).

Mr. Jouy collected the type of this species, a fine female, at Fusan, in March, 1885.

Mr. Buturlin has very kindly called my attention to the fact that this is probably the species described and figured by David and Oustalet^a under the name of *Ptynx fuscescens*. According to these authors, the species lives in Manchuria, ranging south in winter to central China. Père David only met with it twice at Pekin, in the coldest winter season.

OTUS SEMITORQUES Temminck and Schlegel.

FEATHER-TOED SCOPS OWL.

Mr. Jouy obtained three specimens of this species at Fusan, an adult male, taken on May 3, 1884, and two adult females, taken on March 20 and May 10, 1884. He also collected two specimens on Tsushima, on June 2, 1885.

^a Oiseau de la Chine, 1877, p. 45, pl. 2.

NINOX SCUTULATUS JAPONICUS Temminck and Schlegel.**JAPANESE BROWN OWLET.**

This form is represented in the Korean collection by an excellent series of nineteen specimens, two males from Seoul, taken on September 18, 1883; a female from the same locality, taken on August 24 of the same year; two males and a female from Nam San, collected on September 19 and 21, 1883; and six males and seven females from Fusan, taken on April 30, 1886, May 3, 10, 12, and 13, 1884, June 1, 1884, and on September 29, 1885.

BUBO TENUIPES Clark.**SMALL-FOOTED EAGLE OWL.**

Bubo tenuipes A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 470 (Fusan, Korea).

It seems probable that a specimen mentioned by Mr. J. H. Gurney,^a which was obtained on the Goto Islands, in the Korean Straits, and is now in the Norwich Museum, should be referred to this species. Possibly *B. tenuipes* is an inhabitant also of Kiusiu, at least of the southern portion. It is very strange that no eagle owl has ever been reported from Hondo.

There are two specimens of this species in Mr. Jouy's collection, taken at Fusan, one on December 17, 1883, the other on February 20, 1884. The former is a male; the latter is not sexed.

Family PITTIDÆ.**PITTA NYMPHA** Temminck.**JAPANESE PITTA.**

There is a pair of this species in Mr. Jouy's collection, taken at Tsushima on June 8, 1885. It is surprising that this bird has never been found on the Korean peninsula; but as no careful work has yet been done along the southern coast adjacent to the Korean Straits, it may yet be discovered in that district.

Order COCCYGES.**Suborder CUCULI.****Family CUCULIDÆ.****Subfamily CUCULINÆ.****CUCULUS CANORUS TELEPHONUS** (Heine).**EASTERN CUCKOO.**

In Mr. Jouy's collection there is an adult male of this species taken at Fusan on May 23, 1886.

^a Ibis, 1886, p. 524.

CUCULUS KELUNGENSIS Swinhoe.**KELUNG CUCKOO.**

Mr. Jouy's collection includes an adult female of this species, taken at Fusan on April 30, 1886, and a young male, also from Fusan, taken September 25, 1885.

Suborder ALCYONES.**Family ALCEDINIDÆ.****ALCEDO ISPIDA BENGALENSIS** (Gmelin).**EASTERN KINGFISHER.**

Mr. Jouy obtained twelve specimens of this subspecies in Korea, seven at Fusan, two adult males, taken on May 25 and June 2, 1886, two adult females, taken on April 15 and June 2 of the same year, one young male, taken September 26, 1886, and two young females, taken on the 15th of the same month; two at Chemulpo, both adult males, taken on May 28 and September 10, 1883, two at Seoul, both young males, taken July 31 and August 21, 1883, and one, an adult male, near Gensan, taken July 27, 1886.

HALCYON ATRICAPILLA (Gmelin).**BLACK-CAPPED KINGFISHER.**

The collection contains a pair of these birds, taken at Fusan on May 25, 1884.

Suborder CORACIAES.**Family CORACIIDÆ.****Subfamily CORACIINÆ.****EURYSTOMUS CALONYX** Sharpe.**CHINESE ROLLER.**

Mr. Jouy collected five birds of this species on Tsushima, four males, taken on May 24, June 2, June 13, and June 25, and a female, taken on June 13, 1885.

Order Pici.**Family PICIDÆ.****DRYOBATES JAPONICUS** (Seeböhm).

The Korean collection contains eleven specimens of this species, five adult males from Seoul, taken September 18, 20, and 21, and October 14, 1883; an immature male taken at Seoul August 16, 1883; four adult females from Seoul taken June 10, August 19, and September 18, 1883, and an adult male from Fusan taken on September 28, 1885.

When compared with a series of ten examples from Yezo and Hondo, Japan, no constant differences can be found. The Korean birds average perhaps rather darker below than the Japanese, but two of the latter are fully as dark, and one of the former is quite light, being almost white below. A specimen from Peking and another from Shanghai also agree with individuals in this series.

DENDRODROMAS LEUCOTOS USSURIENSIS (Buturlin).

KOREAN WHITE-BACKED WOODPECKER.

Dryobates leuconotus ussuriensis BUTURLIN, Mitth. Kauk. Mus., vol. 3, pt. 1, 1907, pp. 47, 62 (April), (Sidemi, southern Ussuriland).

Dryobates leucotos coreensis A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 472 (June), (Fusan, Korea).

Dendrodromas leuconotus ussuriensis BUTURLIN, Ann. Mus. Zool. Acad. Imp. Sci. St.-Petersbourg, vol. 13, 1909, p. 233.

In the preliminary paper describing the new forms in Mr. Jouy's collection I diagnosed the Korean white-backed woodpecker, calling it *Dryobates leucotos coreensis*; but while my paper was in press, two months before it was published, Mr. Buturlin described the same thing under the name of *Dryobates leuconotus ussuriensis*, from specimens taken at Sidemi, in the southernmost part of Ussuriland, near the Korean boundary. In the same paper I described as new *Dryobates leucotos ussuriensis* from central Ussuriland, a quite different form. Mr. Buturlin's *ussuriensis* is the same as my *coreensis*, and the latter therefore lapses into the synonymy of the former; but his name *ussuriensis* preoccupied my name *ussurianus* used for quite a different bird, which he has consequently renamed. Mr. Buturlin had the kindness to straighten out the whole matter in correspondence, and later published an account of this somewhat curious nomenclatorial entanglement, at the same time taking the opportunity of more clearly bringing out the differential characters of the forms.

There are two males and two females of this subspecies in Mr. Jouy's collection, taken at Fusan on September 30, and October 3, 1885.

YUNGIPICUS KIZUKI SEEBOHMI (Hargitt).

SEEBOHM'S PIGMY WOODPECKER.

The collection contains a male of this subspecies taken at Seoul July 5, 1883, and a female from the same locality taken on October 14, 1883.

YUNGIPICUS KIZUKI NIGRESCENS (Seebohm).

RIUKIU PIGMY WOODPECKER.

Two female pigmy woodpeckers taken on Tsushima May 18 and June 2, 1885, appear to be referable to this form, rather than to *Y. k. kizuki* of Kiusiu. They agree perfectly with a bird from Miyakeshima.

YUNGIPICUS SCINTILLICEPS DOERRIESI (Hargitt).**AMUR PYGMY WOODPECKER.**

This subspecies is represented in the Korean collection by a series of nine birds, eight from Seoul and one from a locality 30 miles east of Seoul, taken in June, August, September, and October, 1883.

GEVINUS CANUS GRISEOVIRIDIS Clark.**KOREAN GREEN WOODPECKER. YAMAGERA.**

Gecinus canus griseoviridis A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 473 (Seoul, Korea).

The collection contains three males of this subspecies from Seoul, taken on September 18 and October 2 and 20, 1883; one male from Gensan, taken April 10, 1884; three females from Seoul taken on September 20 and October 2, 1883, and a female from Gensan taken April 26, 1884.

Order MACROCHIRES.**Suborder CAPRIMULGI.****Family CAPRIMULGIDÆ.****CAPRIMULGUS JOTAKA Temminck.****ORIENTAL GOATSUCKER.**

Mr. Jouy's collection contains a male of this species, taken at Fusan on April 28, 1884.

Suborder CYPSELL.**Family MICROPODIDÆ.****Subfamily CHÆTURINÆ.****CHÆTURA CAUDACUTA (Latham).****NEEDLE-TAILED SWIFT.**

In the collection there is a specimen of this swift, taken 8 miles south of Seoul, September 26, 1883. It agrees perfectly with others from Japan.

Subfamily MICROPODINÆ.**MICROPUS PACIFICUS (Latham).****WHITE-RUMPED SWIFT.**

Mr. Jouy's collection includes a female of this species from Fusan, taken on May 2, 1886, which agrees perfectly with another at hand from Chifu.

Order Passeres.

Suborder OSCINES.

Family MUSCICAPIDÆ.

TERPSIPHONE ATROCAUDATA (Eyton).

PARADISE FLYCATCHER.

Muscipeta princeps of Temminck^a is preoccupied by *Muscipeta princeps* Vigors;^b the next available name appears to be that of Eyton, *Muscipeta atrocaudata*,^c by which the species should be known.

There are four males of this form in the Korean collection, taken at Fusan on May 3 and 11, 1884, and a female, taken on the latter date. One of these males is interesting in having the entire outer web of the right central rectrix light pearl gray. The collection also contains a female and a male without elongated rectrices, both taken at Fusan in May.

MUSCICAPA GRISEICTICTA Swinhoe.

GRAY-SPOTTED FLYCATCHER.

Mr. Jouy's collection contains a male and three females of this species, taken at Fusan on September 23, 26, and 28, 1885.

ALSEONAX LATIROSTRIS (Raffles).

BROAD-BILLED FLYCATCHER.

There are two males from Seoul, taken October 2 and 4, 1883, and a female from Fusan, secured June 1, 1884, in the collection. On the label of the latter is written: "Iris very dark brown; base of bill flesh color: in pines."

HEMICHELIDON SIBIRICA (Gmelin).

SIBERIAN FLYCATCHER.

The collection includes a male from Seoul, taken October 2, 1883, and a female, taken May 28, 1883, at Chemulpo. On the label of the male is written: "Rare; one specimen seen in pines." The specimens agree with others from the Commander Islands and Kamchatka.

ERYTHROSTERNA ALBICILLA (Pallas).

WHITE-TAILED FLYCATCHER.

There are three males of this species in the collection, taken at Seoul on October 4, 6, and 8, 1883.

^a Planch. Color., vol. 3, 1835, pl. 584.

^b Proc. Comm. Sci. Cor. Zool. Soc., London, pt. 1, No. 2, p. 22, Feb. 1, 1831.

^c Proc. Zool. Soc., 1839, p. 102.

XANTHOPYGIA XANTHOPYGIA (Hay).**YELLOW FLYCATCHER.**

This species is represented in Mr. Jouy's collection by an excellent series of fifteen specimens; nine adult males from Seoul, taken on June 10, 14, 15, 16, and 19, and August 2, 1883; three adult females from Seoul, taken on June 14, 15, and 30, 1883; one young male from Seoul, taken June 15, 1883, one young male from Chemulpo, taken September 8, 1883, and one adult male from Fusan, taken May 7, 1884.

XANTHOPYGIA NARCISSINA (Temminck).**NARCISSUS FLYCATCHER.**

There are five specimens of this species in the Korean collection; four males and one female, all taken at Fusan, the dates of capture being April 27 and May 10 and 11, 1884, and May 2, 1886.

POLIOMYIAS FERRUGINEA (Gmelin).

The collection includes a fine series of thirty-five specimens of this species, twenty-three males and twelve females, thirty-one taken at Seoul on October 1, 2, 4, 6, 8, 14, and 20, 1883, and four from Fusan, two taken May 2, 1886, one June 1, and one October 19, 1884.

The autumn males are washed with slate gray above, due to wide edgings of this color on the feathers, especially on the head and rump. The spring males are dark sooty gray above, somewhat lighter on the rump, but dark again on the upper tail coverts. The under parts appear to be practically the same at all seasons.

CYANOPTILA BELLA (Hay).**BLUE AND BLACK FLYCATCHER. ORURI.**

Mr. Jouy's collection includes eleven specimens of this handsome species, eight from Fusan, seven adult males taken on April 27 and May 3, 1884, April 27, 1885, and April 27, 1886, and one adult female, taken April 27, 1885; and three from Seoul, an adult male, taken September 20, 1883, and two adult females taken September 18 and 19, 1883.

LANTHIA CYANURA (Pallas).**SIBERIAN BLUE-TAIL. BLUESTART.**

There are in the collection two specimens of this species, a male and an immature female, taken at Seoul, October 24, 1883. On the label of the male is written "Iris dark brown."

LARVIVORA CYANE (Pallas).**BLUE FLYCATCHER.**

There are three specimens of this species in the collection, all from Fusan, one adult male taken May 11, 1886, and two adult females, taken May 7, 1884, and May 1, 1886.

Family CAMPEPHAGIDÆ.

PERICROCOTUS CINEREUS INTERMEDIUS Clark.**KOREAN MINIVET.**

Pericrocotus cinereus intermedius A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 474 (Seoul, Korea).

There are in Mr. Jouy's collection nine specimens of this form; four males from Fusan, taken on April 27, 1884, April 25, 1886, and May 3, 1885; two males from Seoul, taken June 10, 1883; two females from Fusan, taken April 27 and 30, 1884, and one female from Seoul, taken June 10, 1883.

Family ZOSTEROPIDÆ.

ZOSTEROPS STEJNEGERI Seeböhm.**STEJNEGER'S WHITE-EYE.**

A female *Zosterops* taken on Tsushima June 6, 1886, and a male taken at Fusan, Korea, October 12, 1884, together with a male from Oshima (the last is the bird mentioned by Doctor Stejneger in Proc. U. S. Nat. Mus., vol. 10, 1887, p. 486; and vol. 16, 1893, p. 636), appear to be rather nearer to Seeböhm's *Z. stejnegeri* than to *Z. japonicus*, inasmuch as they are larger in size than the latter with longer bills.

Family ALAUDIDÆ.

ALAUDA ARVENSIS BLAKISTONI Stejneger.**KAMCHATKAN SKYLARK.**

Mr. Jouy's collection contains two males of this species from Fusan, taken on January 30, 1884, and a female from Seoul, taken on September 23, 1883, identical with birds from Kamchatka, the Commander Islands, and the Kurils.

ALAUDA ARVENSIS INTERMEDIA (Swinhoe).**TARTARY SKYLARK.**

In the collection there are two males of this subspecies taken at Seoul, May 5, 1886 and September 28, 1883, another male taken at Fusan, December 5, 1883, and a female from Fusan, taken on April 20, 1884. They agree with a specimen from Vladivostok.

GALERIDA CRISTATA COREENSIS (Taczanowski).**KOREAN CRESTED LARK.**

The collection includes six specimens of this form, two adult males from Chemulpo, taken on September 8 and 10, 1883, two adult females from the same locality, taken September 3 and 10, 1883, an adult female from Fusan, taken January 18, 1885, and a young male from Fusan, taken October 2, 1885.

Family CORVIDÆ.

Subfamily GARRULINÆ.

PICA PICA SERICA Gould.

CHINESE MAGPIE.

There are six specimens of the Chinese magpie in the collection, three males, taken at Seoul on June 21, 24, and 25, 1883, and two males, taken at Fusan on March 9, 1885, and March 12, 1884.

GARRULUS JAPONICUS (Schlegel).

JAPANESE JAY.

There is a male of this species in Mr. Jouy's collection from Tsushima, taken on May 21, 1886, and two others from the same place, unsexed and undated. It is rather strange that this species should never occur in Korea, when it occurs so near as Tsushima. The only jay known from Korea is *G. brandti*, which replaces this species in the north of Japan (Yezo). Possibly some jay near *G. japonicus* will in the future come to light on the as yet unknown southern coast.

Subfamily CORVINÆ.

CORVUS TORQUATUS Lesson.

CHINESE WHITE-COLLARED CROW.

There is a fragmentary specimen of this species in the National Museum collection which was obtained by Mr. Jouy at Yokohama, Japan. It seems most probable that it was an escaped cage bird, though there is no reason why this species should not be found, at least occasionally, in southern Japan.

CORVUS CORONE ORIENTALIS Eversmann.

EASTERN CARRION CROW.

There are four specimens of this bird in Mr. Jouy's collection, taken at Seoul and Fusan in February, July, November, and December.

CORVUS MACRORHYNCHOS JAPONENSIS Bonaparte.

JAPANESE RAVEN.

Mr. Jouy collected two birds of this species at Seoul on July 27, 1883.

COLLEUS DAURICUS (Pallas).

PALLAS' JACKDAW.

Pallas' Jackdaw is represented in the collection by six specimens, a male and three females taken between Seoul and Fusan on November 22 and 23, 1883, and a female taken at Fusan on February 11, 1884.

I can not help inclining toward the belief, already several times expressed by others, that the following is but a color phase of this

species, just as I hold *Cereba atrata*, *C. wellsi*, and *C. lauræ* to be merely melanotic phases of the species of that genus inhabiting the same localities. An examination of young birds in the nest would throw an interesting light on the question.

COLCEUS NEGLECTUS (Schlegel).

BLACK JACKDAW.

This form is represented in the collection from Korea by four specimens; three males, one taken at Fusan on February 11, 1884, and two between Seoul and Fusan on November 23, 1883, and a female taken between Seoul and Fusan on the latter date.

NUCIFRAGA CARYOCATACTES MACRORHYNCHOS (Brahm).

NUTCRACKER.

The collection contains three males and a female of this subspecies from Fusan, taken on September 23 and 27, 1885.

Family STURNIDÆ.

SPODIOPSAR CINERACEUS (Temminck).

GRAY STARLING.

The collection contains a male and a female of this starling taken at Seoul on January 14, 1883.

Family ORIOLIDÆ.

ORIOLOUS DIFFUSUS Sharpe.

CHINESE ORIOLE.

Mr. Jouy's collection contains two adult males taken near Seoul on June 17, 1883, a young male taken thirty miles east of Seoul on August 12, 1883, and an adult female taken near Chemulpo on September 8, 1883.

Family FRINGILLIDÆ.

COCCOTHAUSTES COCCOTHAUSTES JAPONICUS (Temminck and Schlegel).

JAPANESE HAWFINCH.

There are in the Korean collection four examples of this species; a male taken at Fusan on December 14, 1884, and three females from the same locality, taken on April 11, 1886, and on December 7 and 14, 1884.

PYRRHULA PYRRHULA GRISEIVENTRIS (Lafresnaye).

ORIENTAL BULLFINCH.

Mr. Jouy's collection includes a fine male from Fusan, taken on April 18, 1886.

CHLORIS SINICA USSURIANUS Hartert.**USSURIAND GREENFINCH.**

Mr. Jouy collected five specimens of this form, all at Seoul, four males, taken on June 10, 12, and 25, 1883, and on October 27 of the same year, and a female taken on the last-mentioned date.

FRINGILLA MONTIFRINGILLA Linnaeus.**BRAMBLING.**

The collection contains two males of this species from Seoul, taken on October 23 and 24, 1883.

EMBERIZA ELEGANS Temminck.**TEMMINCK'S YELLOW-BROWED BUNTING.**

There are four adult males of this species in the collection from Fusan, taken November 30, 1883, April 19 and December 14, 1884, and April 26, 1886; an adult female taken at Seoul on October 24, 1883; and an adult male, with no data attached.

EMBERIZA FUCATA Pallas.**GRAY-HEADED BUNTING.**

There is a single adult male of this species in the collection, taken thirty miles east of Seoul on August 12, 1883.

EMBERIZA CASTANEICEPS Moore.**CHESTNUT-HEADED BUNTING.**

The collection contains seven specimens of this species, five from Fusan, four males taken on January 30 and April 20, 1884, and on May 3, 1885, and a female taken on the last-named date; and two young males from thirty miles east of Seoul, taken on August 12, 1883.

EMBERIZA TRISTRAMI Swinhoe.**TRISTRAM'S BUNTING.**

This species is represented in the collection by a male from Seoul, taken October 14, 1883, another from Fusan, taken April 27, 1885, and three females from Seoul, taken on October 4 and 8, 1883.

PASSER MONTANUS ORIENTALIS Clark.**EASTERN TREE SPARROW.**

Mr. Jouy collected two males of this form at Fusan on November 8, 1885.

Family HIRUNDINIDÆ.

HIRUNDO RUSTICA GUTTURALIS (Scopoli).**EASTERN CHIMNEY SWALLOW.**

There are four females of this bird in Mr. Jouy's collection, one taken at Fusan on April 28, 1886, and three taken at Seoul on June 10 and 19 and on August 2, 1883.

RIPARIA RIPARIA (Linnaeus).**BANK SWALLOW; SAND MARTIN.**

There is a male of this wide-ranging species in the collection taken at Seoul on September 29, 1883.

Family LANIIDÆ.

LANIUS LUCIONENSIS Linnaeus.**CHINESE RED-TAILED SHRIKE.**

In the collection there are ten specimens of this species, four from Fusan, two adult males taken May 17 and July 9, 1884, an adult female taken July 9, 1884, and a young bird taken December 14, 1884; five from Seoul, two adult males taken on June 14 and 19, 1883, two adult females taken on June 5 and 15, 1883, and a young male taken on July 31, 1883; and one from Gensan, an adult female taken on July 24, 1886.

LANIUS MAGNIROSTRIS Lesson.**THICK-BILLED SHRIKE.**

A male taken at Fusan on May 22, 1886, and another taken at Tsushima on June 6, 1885, represent this species in Mr. Jouy's collection.

LANIUS SPHENOCERCUS Cabanis.

There are in the collection two males and a female of this species taken in central Korea on November 16, 18, and 21, 1883, and a male taken near Seoul on September 28, 1883.

Family MOTACILLIDÆ.

MOTACILLA LUGENS Kittlitz.**BLACK-BACKED KAMCHATKAN WAGTAIL.**

There is a male of this species in Mr. Jouy's collection taken near Seoul on September 29, 1883.

MOTACILLA LEUCOPSIS Gould.**GRAY-BACKED WAGTAIL.**

In the collection there are two males of this species from Seoul, taken on September 20 and 26, 1883. They agree with Chinese examples.

BUDYTES FLAVUS SIMILLIMA Hartert.**KAMCHATKAN YELLOW WAGTAIL.**

A young female Yellow Wagtail taken by Mr. Jouy at Fusan on September 23, 1885, appears to be referable to this form.

BUDYTES BOARULA MELANOPE (Pallas).**EASTERN GRAY WAGTAIL.**

A female of this form taken at Seoul, Korea, on October 7, 1883, agrees with others from China and Japan.

ANTHUS GUSTAVI Swinhoe.**SCHLEGEL'S TITLARK.**

A specimen taken by Mr. Jouy at Seoul on September 23, 1883, agrees with others from Copper and Bering islands and from Kamchatka.

ANTHUS RICHARDI STRIOLATUS (Blyth).**BLYTE'S PIPIT.**

A male taken by Mr. Jouy 8 miles south of Seoul on September 26, 1883, agrees with specimens from Hongkong taken in October.

PIPASTES MACULATUS (Jerdon).**EASTERN TREE PIPIT.**

In Mr. Jouy's collection there is a male and an unsexed specimen taken at Seoul on October 2 and 14, 1883.

DENDRONANTHUS INDICUS (Gmelin).**INDIAN TREE PIPIT.**

Mr. Jouy's collection contains three males and four females of this species, all taken at Seoul on June 2, 10, 15, 16, 23, and 29, 1883.

Family TROGLODYTIDÆ.**NANNUS FUMIGATUS PENINSULÆ** (Clark).**KOREAN WREN. MISOSAZAI.**

Olbiorchilus fumigatus peninsulæ A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 474 (Fusan, Korea).

Mr. Jouy's collection includes a pair of this species, a male taken at Fusan on December 14, 1884, and a female from the same place taken on December 4, 1885.

Family CERTHIDÆ.**CERTHIA FAMILIARIS SCANDULACA** (Pallas).**SIBERIAN CREEPER.**

A male creeper taken at Fusan on November 15, 1884, another taken at Seoul November 5, 1883, and an unsexed specimen from

Fusan taken November 15, 1884, appear to be referable to this subspecies. They are darker, with less white, than specimens from Yezo, and are also smaller. This disposition of these birds is merely provisional, the material available for comparison being much too scanty to admit of accurate determination.

Family PARIDÆ.

PENTHESTES PALUSTRIS CRASSIROSTRIS (Taczanowski).

THICK-BILLED MARSH-TIT.

The collection contains three adult males of this form taken at Seoul on August 21 and September 20 and 24, 1883. and an immature male taken on July 5, 1883.

PROPAROIDES VARIUS VARIUS (Temminck and Schlegel).

JAPANESE TIT-MOUSE.

The collection contains seven specimens of this species from Fusan, five males taken on October 19, 1884, and April 18, 1886, and two females taken on October 12, 1884; and seven specimens from Seoul, three males taken June 10, September 23, and October 14, 1883, and four females, taken on June 12, September 21, October 14, and October 20, 1883. Compared with a series of eighteen specimens from Yezo and Hondo, no differences can be found not attributable to the somewhat different make of the skins.

I am inclined to believe that this species is a regular winter visitor from Japan, possibly occurring more abundantly at certain seasons than at others. I do not know of any specimens ever having been taken in Korea in the breeding season, although it is a common breeding resident on Tsushima. Specimens of this bird from the islands along the southern coasts of Hondo and Kiusiu, from the Linschoten and Riu Kiu islands, and breeding birds from Kiusiu, especially the southern part, are very desirable in order to ascertain the relationship of *P. v. varius* with *P. v. castaneoventris* of Formosa and Okinawashima, and with *P. owstoni* of the Seven Islands.

ACREDULA CAUDATA MACROURA Seebohm.

SEEBOHM'S LONG-TAILED TIT.

Three specimens of Long-tailed Titmice from Korea and one from the Amur region have puzzled me considerably. They agree perfectly between themselves, but differ from examples from Europe and Japan in being somewhat larger, with much longer tails, and with the white on the wings somewhat more restricted. From the material at hand I can not find the slightest difference between typical European and Japanese specimens. The birds from Korea and the Amur I have referred provisionally to Seebohm's *A. c. macroura*, as they appear to

come under his somewhat insufficient diagnosis of that form, although I may state that I am not at all certain they belong here. I have not been able to examine a specimen of true *A. c. macroura*, and have been forced to rely on descriptions. An example of Seebohm's *A. c. sibirica* from Krasnoyarsk agrees in size and length of tail with my Korean and Amur birds, but differs widely in the great amount of white on the wings.

A male, taken at Seoul, Korea, October 24, 1883, measures, wing, 67 mm.; tail, 99 mm.; tarsus, 17 mm.

A male of *A. c. sibirica* measures, wing, 67 mm.; tail, 100 mm.; tarsus, 17 mm.

A male, taken at Sapporo, Yezo, October 23, 1883, measures, wing, 64 mm.; tail, 84 mm.; tarsus, 17 mm.

Two females, taken at Seoul, Korea, on October 14 and 24, 1883, average, wing, 64.5 mm.; tail, 91 mm.; tarsus, 17 mm.

ACREDULA TRIVIRGATA MAGNA Clark.

KOREAN LONG-TAILED TIT.

Acredula trivirgata magna A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 475 (Seoul, Korea).

Mr. Jouy's collection contains the type of this species, an adult male, taken at Seoul on October 24, 1883.

REMIZ CONSOBRINUS SUFFUSUS Clark.

KOREAN PENDULINE TIT.

Remiz consobrinus suffusus A. H. CLARK, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 474 (Fusan, Korea).

Mr. Jouy's collection contains two adult males of this form taken near Fusan on December 21, 1884.

SUTHORA WEBBIANA MANDSCHURICA (Taczanowski).

MANCHURIAN SUTHORA.

Three birds, a male and two females, taken near Seoul on August 12, 1883, appear to be referable to this subspecies. Unfortunately the genus is not very well represented in the National Museum collection, and I have had to depend largely on published descriptions. They differ from a specimen which I take to represent *S. w. webbiana*, from Shen Si, exactly as described by Mr. Campbell in his description of *S. longicauda* (= *S. mandschurica*) in the Ibis for 1892, p. 237.

SUTHORA FULICAUDA Campbell.

KOREAN SUTHORA.

Two female Suthoras, taken at Fusan, one on April 11, 1886, and the other on April 30, 1884, I have determined as belonging to this species. Mr. Campbell's suggestion that this may prove to be the Japanese species seems quite plausible.

Family SYLVIIDÆ.**Subfamily SYLVIINÆ.****ACANTHOPNEUSTE CORONATA (Temminck and Schlegel).****TEMMINCK'S CROWNED WILLOW WARBLER.**

The collection contains a female of this species taken on Tsushima on May 28, 1885; one male and five females, taken at Seoul on August 6, 10, and 19, and October 2 and 14, 1883; and three males from Fusan taken on May 4 and 7, 1884, and on May 3, 1885.

PHYLLOSCOPUS SUPERCILIOSUS (Gmelin).

Three males, taken at Seoul, Korea, on October 4 and 6, 1883, agree with specimens from Shanghai, Hongkong, Canton, and Siam.

ACROCEPHALUS ORIENTALIS (Temminck and Schlegel).**CHINESE GREAT REED WARBLER.**

The collection contains four males and a female of this species taken at Gensan on July 24 and 27, 1886. They are all in exceedingly worn plumage.

CETTIA CANTANS (Temminck and Schlegel).**LARGE JAPANESE BUSH WARBLER.**

The collection contains a male of this species, taken May 19, 1885.

CETTIA CANTURIANS (Swinhoe).

There is a male of this species in the collection taken at Seoul October 14, 1883.

UROPHLEXIS USSURIANA (Seeböhm).

The collection includes three males and a female of this form taken at Fusan on April 25 and on May 2 and 3, 1886. On one of the labels is written "Iris very dark brown."

Family PYCNONOTIDÆ.**HYPSIPETES AMAUROTIS HENSONI (Temminck).****HENSON'S BROWN-EARED BULBUL.**

Mr. Jouy's collection includes a male of this subspecies taken at Fusan on November 30, 1883, and another taken on Tsushima on May 28, 1885.

Family TURDIDÆ.**Subfamily TURDINÆ.****OREOCINCLA VARIA (Pallas).****WHITE'S GROUND THRUSH.**

A wing and two legs from a specimen taken at Fusan April 22, 1886, I refer with some hesitation to this species. Compared with

the wings of birds from Japan, this wing is much lighter and duller, and also somewhat shorter. The measurements of the fragments are, wing, 154 mm.; tarsus, 34 mm.

CICHLOSELYS SIBIRICUS (Pallas).

SIBERIAN GROUND THRUSH.

The collection contains a male of this species taken at Fusan September 23, 1885, and a female from the same place taken May 7, 1884.

TURDUS CARDIS Temminck.

GRAY JAPANESE OUZEL.

In the collection there is an adult female of this species taken at Fusan, April 25, 1884, and a young male from the same locality taken April 26, 1886.

TURDUS EUNOMUS Temminck.

A male and a female taken at Fusan on March 12, 1884, represent this species.

TURDUS NAUMANNI Temminck.

RED-TAILED OUZEL.

This species is represented by an adult male taken at Fusan on January 3, 1886.

TURDUS OBSCURUS Gmelin.

EYEBROWED THRUSH. DUSKY OUZEL.

A male taken at Fusan on May 3, 1884, is in the collection.

TURDUS PALLIDUS Gmelin.

PALE OUZEL.

The collection includes three males and two females of this species from Fusan taken on April 25, 28, and 29, 1884.

TURDUS CHRYSOLAUS Temminck.

BROWN JAPANESE OUZEL.

A male taken at Fusan, May 3, 1884, and another taken on the 7th of the same month represent this species.

PETROPHILA MANILLA (Boddaert).

BLUE AND RED ROCK THRUSH.

Mr. Jouy's Korean collection contains three males, one taken at Fusan on April 28, 1884, one at Chemulpo on September 7, 1883, and the other with no data other than Fusan. He also obtained a specimen on Tsushima on May 26, 1885.

A series of 16 birds from China, Korea, Japan, Tsushima, the Riu Kiu Islands, and Formosa appears to be fairly uniform. The

specimen from Tsushima is very dark on the underparts, and somewhat brighter above than any of the others. One from Formosa, however (taken in November), is nearly as dark. These two specimens also agree in having longer wings and shorter tails than any of the rest.

A male, not quite adult, in the National Museum collection is partially albinistic above.

ERITHACUS SIBILANS Swainson.

EASTERN ROBIN.

The collection contains a female of this species from Seoul taken October 1, 1883.

PRATINCOLA MAURA (Pallas).

EASTERN STONE-CHAT. NOBITAKI.

This species is represented in Mr. Jouy's collection by two males from Fusan taken on April 20, 1884, and April 24, 1885; three females from Fusan taken on April 19 and 25, 1885, and on April 11, 1886, and an immature male from Chemulpo taken September 10, 1883.

PHENICURUS AUROREUS (Pallas).

DAURIAN REDSTART.

There are in the collection six specimens of this bird, all from Seoul; four adult males taken on June 12, August 21, and October 8, 1883; an adult female taken on August 2, 1883, and an immature bird taken on June 16, 1883.

ON SOME LAND SHELLS COLLECTED BY DR. HIRAM BINGHAM IN PERU.

By WILLIAM HEALEY DALL,

Curator, Division of Mollusks, U. S. National Museum.

During a recent mission to Peru Dr. Hiram Bingham, of Yale University, made a small collection of land shells in a little visited part of Peru, which through his kindness and that of Dr. Leon J. Cole of that university were in part sent to me for examination. Other portions of the collection were presented by Doctor Bingham to Mr. Barbour of the Museum of Comparative Zoology, who kindly lent them for study, and Doctor Cooke of the Bishop Memorial Museum at Honolulu.

Doctor Bingham thus describes the locality where the shells were found, of which the accompanying illustration, from a photograph taken by him, will aid in characterizing their habitat.

We left Chincheros on February 17 about 10 o'clock in the morning, reaching the battlefield of Bombon at 11.15 and having our first view of the Rio Pampas at 12.45 p. m. Its height above the sea at this point is about 6,000 feet.

On its banks are mimosa trees and several varieties of cactus. The shells occurred in great profusion both on the cactus and the mimosas which struck me as very odd, as I had collected many land shells on the Hawaiian Islands and do not remember to have ever seen shells in such profusion anywhere. Furthermore in the Hawaiian Islands they very rarely live on either cactus or mimosa, preferring the indigenous plants and trees.

After reaching the level of the river our path followed it in a northerly direction downstream for some distance amongst groves of mimosa trees and different kinds of cacti. This is a famous place for mosquitoes, and there is said to be a great deal of malaria in the vicinity.

The bridge over the Rio Pampas has long attracted the notice of travelers. There are two pictures of it in E. G. Squier's book on Peru, and although wire rope has replaced the old cables it is still a most unwelcome feature of the road from the point of view of the mules. The bridge to-day is at the foot of perpendicular cliffs. The surrounding scenery is not so imposing as that of the valley of the Apurimac, but is nevertheless magnificent. The bridge is about 150 feet long and about 50 feet above the river. After leaving the bridge we ascended a precipitous cliff by a narrow winding path and found ourselves on a terrace where enterprising Peruvians had planted fields of sugar cane.

The trees and shrubs on which I found the shells were not more than 50 or 75 feet above the river. I should judge from the presence of the mimosa and cactus that the region was not a very rainy one. The shells were placed so thickly on the trunks of

the trees as to make them faintly white in places as large as the palm of one's hand. I estimated that on some of the cacti there were fully 500 shells of all sizes. They seemed to prefer the vicinity of the ground and I saw very few shells on the upper branches or on the leaves. I did not see any shells until the path approached the bank of the stream at an altitude of about 50 feet above the level of the water. Our path ran beside the bank of the stream for at least 2 miles and possibly 3, the shells occurring in great profusion during the entire distance. After we crossed the river on the bridge we saw no more shells, for we climbed at once to the terrace a couple of hundred feet above the river and thus proceeded to Pajonal.

The shells occur on the trees in the immediate foreground of the picture.

The shells comprised various species and varieties of *Bulimulus* and a single species of *Clausilia*. The latter was submitted to Dr. H. A. Pilsbry, who has kindly furnished a description of it.

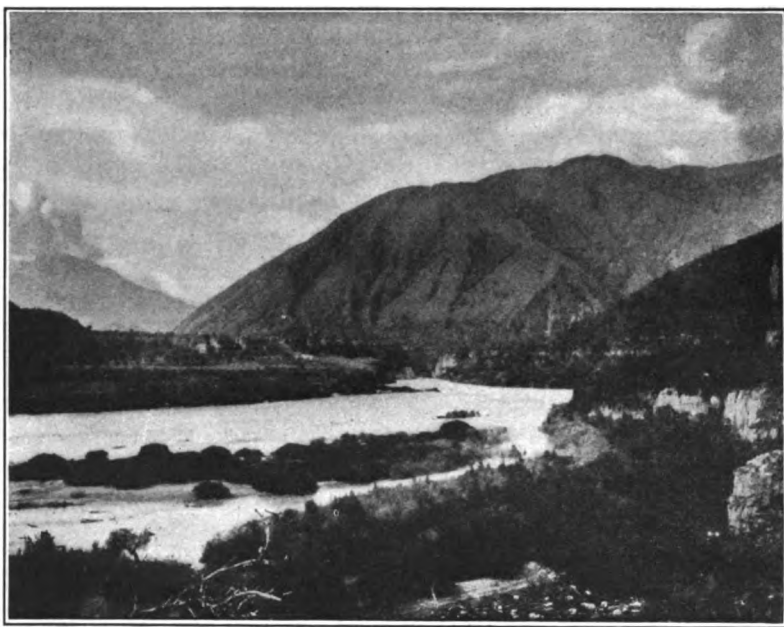


FIG. 1.—VIEW OF THE RIO PAMPAS LOOKING DOWNSTREAM.

LIST OF THE SPECIES COLLECTED.

BULIMULUS (BOSTRYX) INFUNDIBULUM Pfeiffer.

Bulimulus infundibulum PFEIFFER, Proc. Zool. Soc. London, 1851, p. 255.—
MORELET, Sér. Conch., vol. 3, 1863, p. 204, pl. 11, fig. 6.

The specimens obtained were some 20 millimeters long, the vertical length of the aperture being 7 millimeters. The color variations were ashy white with a brownish nucleus, the same streaked with tawny brown, and lastly with two (not one as stated by Morelet in contradiction to his figure) brown spiral bands. The apex is more produced and mammillary than in Morelet's figure. He states that it was found on grasses in stony places, and gives the habitat as the high-

lands between the valley of Abancay and that of Ayacucho. The species has an arboreal aspect and the statement that it was found on grasses, in view of Doctor Bingham's experience, seems to need confirmation.

U. S. Nat. Mus. No. 209266.

BULIMULUS (BOSTRYX) UMBILICATELLUS Pilsbry.

Bulimulus (Bostryx) infundibulum, var. *umbilicatelus* PILSBRY, Manual, vol. 10, 1895, p. 131, pl. 44, figs. 93, 94.

The specimens obtained were ashy white, with livid brown coloration near the tip of the spire and in the umbilicus, and somewhat fainter in the aperture. The profile is more convex toward the middle; that is, the shell is more spindle-shaped and less evenly conic than the specimen figured in the Manual, and the umbilicus more tubular and less funicular. The nucleus has about $3\frac{1}{2}$ translucent smooth whorls and the remainder of the shell $7\frac{1}{2}$ whorls. The axial striation does not differ, in the specimens examined, from that carried by *B. infundibulum*. The length of the shell is 21, the maximum diameter 6, the vertical height of the aperture 6.5 mm. In the absence of connecting gradations this seems to be a good species.

U. S. Nat. Mus. No. 209267.

BULIMULUS (BOSTRYX) ALBICOLOR Morelet.

Bulimulus albicolor MORELET, Journ. de Conchyl., vol. 8, p. 374, 1860; Sér. Conch., vol. 3, 1863, p. 199, pl. 11, fig. 9.

The average of specimens of this form obtained were intermediate in size between the figures given for his extremes by Morelet, otherwise agreeing precisely with his figures and descriptions. The series examined, however, shows variations in the umbilical region from closed and merely rimate, to nearly as wide as in the next species, of which I am inclined to consider it a mere mutation. According to Angrand this form inhabits Huanta and the valley of the Apurimac River, Peru.

U. S. Nat. Mus. No. 209268.

BULIMULUS (BOSTRYX) OROPHILUS Morelet, var. **CEREICOLA** Morelet.

Bulimus cereicola MORELET, Sér. Conch., vol. 3, 1863, p. 192, pl. 9, fig. 7.

Bulimus lesueurianus MORELET, Sér. Conch., vol. 3, 1863, p. 200, pl. 9, fig. 4.

Bulimus orophilus MORELET, Sér. Conch., vol. 3, 1863, p. 189, pl. 9, fig. 6, 6 bis.

Bulimus albicolor MORELET, Sér. Conch., vol. 3, 1863, p. 199, pl. 9, fig. 9.

This species was the most abundant of those collected, comprising the axially streaked (*cereicola*), the spirally banded (*lesueurianus*), and the plain whitish (*albicolor*); with the umbilicus varying from wide to entirely closed. The typical color form with the base dark colored and the portion above the periphery axially streaked, does not happen to occur in Doctor Bingham's collection. The color of the nucleus varies from pale to dark horn color or pink and even dark

livid brown. The umbilicus varies as above stated, the color variations are from pale unicolorate to profusely brown axially streaked or with two dark spiral bands, of which one is above the periphery and the other below it, the latter being covered by the advancing whorl. The form is quite constant, being rather elongate and attenuate toward both ends. The *B. stenacme* Pfeiffer, *B. reconditus* and *nigropileatus* Reeve, are all of a more conical type, with a broader not attenuate last whorl, and while doubtless to be united with each other under the earliest name, are, so far as my material permits me to judge, better kept separate from the present group as Morelet proposed.

The species is reported on Angrand's authority as living on cacti of the genus *Cereus*, in the interior of the sierra west of Cuzco, in the valleys of Abancay and Acostambo, and is doubtless widely distributed.

U. S. Nat. Mus. No. 209269.

BULIMULUS (LISSOACME) BINGHAMI, new species.

Shell stout, wide, conic, with a smooth nucleus of about two whorls and four subsequent whorls; for somewhat over two whorls the young shell has a prominent keel against which the suture is closely appressed, so that the presence of the keel requires close examination to recognize; a little beyond the end of the second whorl the keel disappears below the suture, and only very obscure traces of it remain on the last whorl; the spire as a whole is convexly conic, the separate whorls project but little; the last whorl rapidly enlarges with a rounded periphery, evenly rounded into a wide subcylindric umbilicus; sculpture of well marked retractorily



FIG. 2.—*BULIMULUS* (LISSOACME) BINGHAMI.

arcuate wrinkles, with subequal interspaces obsoletely spirally striate; the sculpture is most obvious on the spire and on the part of the last whorl behind the periphery; toward the aperture the whorl descends a little below the periphery; the well-reflected outer lip bends markedly toward the posterior end of the pillar lip, and the two are joined by a thin glaze over the body; the pillar lip is very broad and thin, half obscuring the umbilicus; the pillar is straight without any twist or fold; the color of the shell is yellowish white, with more or less distinct pale brownish spiral lines or narrow bands; the lip is whitish, the interior of the aperture pale yellowish-brown; the nucleus is slightly mammillary. Height of shell, 36; of last whorl, 19; of aperture (vertical), 13; maximum diameter of shell, 20; of aperture, 11; of umbilicus, 2.5 mm.

Collected from cacti on the banks of the Rio Pampas, Peru, by Dr. Hiram Bingham.

This species might be assigned either to the group of *B. reentzi* Philippi or *B. derelictus* Broderip, but differs in specific characters from either of the known species assigned to these groups. I have much pleasure in naming it after the collector.

Type.—U. S. Nat. Mus. No. 209270.

BULIMULUS (LISSOACME) PTYALUM, new species.

Shell plump, conic, with a mammillary smooth brown nucleus and a generally bluish white color with sparse irregularly distributed black dots; nucleus with two and a half translucent whorls and an apical dimple; subsequent whorls feebly rounded, with an appressed suture which is in the earlier whorls laid against a peripheral angle of which there is no trace in the later ones; sculpture of fine feeble retractive flexuous wrinkles, usually with narrower interspaces, becoming obsolete on the last whorl, and crossed by fine feeble spiral striation, most evident in the interspaces on the earlier whorls; last whorl somewhat produced, moderately rounded, and curving roundly into a deep subcylindric umbilicus; aperture semilunate, the basal and outer margins paler, reflected; interior and pillar dark brownish; the lips approach each other on the body, the outer one hardly descending, the inner one wide, hardly reflected over the umbilicus; pillar without twist or fold. Height of shell 25; of last whorl 18; of aperture 8.5; of umbilicus 1.7 mm.



FIG. 3.—*BULIMULUS*
(*LISSOACME*)
PTYALUM.

On cacti and mimosa on the banks of the Rio Pampas, Peru, collected by Doctor Bingham.

This species evidently belongs to the same group as the last, though specifically distinct. It has some resemblance to the *B. rhodolarynx* of Reeve (placed by Pilsbry provisionally in the genus *Neopetræus*) but is a much smaller shell, with more ovoid and less protracted aperture.

Type.—U. S. Nat. Mus. No. 209271.

CLAUSILIA (NENIA) PAMPASENSIS Pilsbry, new species.

The shell is slender, fusiform, somewhat attenuated at the apex, lustreless, gray-white over a dull brown surface, visible where the outer sculptured layer is rubbed off. Sculpture of very fine and close, unequal and uneven striæ in the direction of growth lines. In places they are discontinuous, forming long, lanceolate granules. This white striate layer is worn off on the ventral side of each whorl. Whorls 12½, the first two brown and glossy. To the fourth or fifth whorl the diameter scarcely increases; then the whorls increase slowly in diameter to the penultimate which is widest, and, like those preceding, is moderately convex. The last whorl is flattened, tapers toward the base, and finally becomes free, descending more rapidly to the

aperture, which stands forward about 1 mm. The neck is deeply grooved above the suture. The aperture is slightly oblique, rounded-ovate, with continuous, reflected, pale brownish peristome. The superior lamella is acute, concave on the left side, continuous with the spiral lamella, which is low and short, running inward to a dorsal position. The inferior lamella is immersed, barely visible in a front view. It ascends in a long sigmoid curve, and is somewhat thickened within. The subcolumellar lamella is wholly immersed. The principal plica is high, dorsal, and less than a half whorl long. The lamella is low and lunate.



FIG. 4.—CLAUSILIA
(NENIA) PAMPA-
SENSIS.

Length 20.1, diameter 3.9 mm.; longest axis aperture 3.8, width 3 mm. The clausilium is evenly curved, slightly twisted spirally, the distal half tapering to the obtuse, thickened apex.

Type.—U. S. Nat. Mus. No. 209272.

By its sculpture this species resembles *C. pilsbryi* Sykes and *C. chacaensis* Lubomirski, but in those the striae are more distinctly interrupted and finer. It differs from both by its short aperture, proportioned more as in *C. epitonium*; both of the other species named having the aperture conspicuously lengthened.

The distinct attenuation of the earlier whorls is a further distinctive feature of the new form.

The latest list of South American Clausiliæ^a enumerates 37 species. A few species described since that time, together with some omitted, brings the number up to about 45 species, exclusive of those Clausiliidæ belonging to the genus *Temesa*. (H. A. P.)

^a E. R. Sykes, Journ. Malac., vol. 5, 1896, p. 57.

FRESH-WATER SPONGES IN THE COLLECTION OF THE
UNITED STATES NATIONAL MUSEUM.—PART III. DE-
SCRIPTION OF A NEW SPECIES OF SPONGILLA FROM
CHINA.

By NELSON ANNANDALE,
Superintendent of the Indian Museum, Calcutta.

Among the specimens of fresh-water sponges that the authorities of the U. S. National Museum have been kind enough to send me for examination recently there are several small fragments labeled "Found on rocks in the canal. From N. Gist Gee, Su-chau [southern Kiang Su, near Shanghai], China." So far as I am aware, no fresh-water sponge has as yet been described from China, although I have recently received specimens, unfortunately not determinable, from Mr. J. Coggin Brown, of the Geological Survey of India, who collected them in Lake Tali Fu in Yunnan. The specimens from Su-chau apparently represent a new species of the genus *Spongilla* and the subgenus *Stratospongilla*, which is here described as—

SPONGILLA (STRATOSPONGILLA) SINENSIS, new species.

Sponge consisting of a flat layer some 4 mm. thick, with short cylindrical upright branches; its color (dry) dirty white; the oscula small but clearly defined.

Skeleton compact, reticulate but not very coherent, little spongin being present; the meshes tending to be polygonal, but neither the radiating nor the transverse fibers very clearly defined.

Spicules smooth, slender, short, somewhat abruptly pointed; the gemmule spicules resembling the skeleton spicules except in their smaller size. No flesh spicules.

Gemmules numerous, small, massed together at the base of the sponge, each with a thick outer chitinous coat full of dark granules; the gemmule spicules lying in this coat parallel or nearly parallel to the inner wall of the gemmule. No foraminal tubule.

	mm.
Length of skeleton spicules.....	0.1740–0.2160
Greatest diameter of skeleton spicules.....	0.0103–0.0125
Length of gemmule spicules.....	0.0750–0.0910
Greatest diameter of gemmule spicules.....	0.0052–0.0083

This sponge appears to be allied to *S. aspinosa* Potts, from which it differs in its compact structure and lack of flesh spicules.

Type-specimen.—Cat. No. 8266, U.S.N.M.

A REVISION OF THE FOSSIL PLANTS OF THE GENUS NAGEIOPSIS OF FONTAINE.

By EDWARD W. BERRY,
Of the Johns Hopkins University, Baltimore.

In the elaboration of the Potomac flora of Maryland for the proposed monograph of the Maryland Geological Survey it has been found necessary to reexamine all of the Virginia material and in many cases to recast certain of the larger genera where the limits have been found to be vague. That the multiplication of species in the past has been much greater than the facts warranted has long been suspected, and several writers, notably Seward, have voiced this view. A careful study only serves to emphasize this opinion, and it is proposed to publish several of these systematic revisions as fast as they are prepared, since the proposed monograph deals mainly with species known to occur in Maryland. Furthermore, the Patuxent formation, the basal member of the Potomac group, is extremely deficient in plant remains in the Maryland area, while a representative flora is present at this horizon in Virginia, so that generic revisions lack balance unless the full data which form the foundation of the new interpretations are given.

The writer has had the advantage of studying at one time all of the specimens collected by Fontaine, Ward, Bibbins, and others, and this method has served to disclose certain errors of identification which resulted from the method of the former, who worked over a long period of years upon collections from a large number of localities and without the various types at hand for comparison. The writer is under obligations to the U. S. National Museum, where all of the Potomac types are lodged, for many courtesies, and he also gratefully acknowledges the constant advice and criticism of Dr. F. H. Knowlton.

The first genus to be considered is *Nageiopsis*, which was founded by Fontaine in 1890, for forms apparently allied to the modern species which make up the *Nageia* section of the genus *Podocarpus*. He characterizes *Nageiopsis* as follows:

Trees or shrubs with leaves and branches spreading in one plane; leaves varying much in size and shape, those toward the base of the twigs sometimes smaller than those higher up, distichous mostly, or rarely subdistichous, opposite and persistent,

attached by a short slightly twisted footstalk, usually to the side of the twig, more rarely slightly within the margin on the upper or under surface of the stem, either attenuated toward the base or abruptly rounded off there, at their ends acute or subacute; nerves several, coalescing at base to form a footstalk, forking immediately at the base or a short distance above, then approximately parallel to near the tips of the leaves, where they are somewhat crowded together, but do not converge to a union, ending in or near the extremity.

The diagnostic characters which deserve emphasis are the branching habit, the persistent leaves, and the parallel veins which do not converge to any great extent in the apex of the leaf. These all serve to distinguish the species of *Nageiopsis* from the cycadaceous fronds or leaflets, with which they are most likely to be confused. The genus *Podozamites*, for example, which is supposed to be Cycadlean, although Seward suggests that it may be Araucarian, is very similar in appearance, so similar in fact that Professor Fontaine included a number of *Podozamites* leaflets in his various species of *Nageiopsis*. But *Podozamites* is usually represented by detached leaves, hence it was deciduous in habit; the fronds are not known to branch, and this is not only a distinguishing character but an argument against an Araucarian affinity; finally, the veins converge, more or less, apically.

Throughout the whole order Coniferales the phyllotaxy is as a rule spiral, more rarely it is cyclic in character. A true distichous or two ranked arrangement is unknown, although a great many conifers with a spiral phyllotaxy are markedly distichous in habit, as for example, *Taxodium*, *Araucaria*, *Tumion*, *Taxus*, etc. It seems probable that *Nageiopsis* was no exception to the general rule; in fact some specimens show leaves inserted on all four sides of the stem. More often, however, the exact method of attachment is obscured, but the more or less twisted base argues strongly for a spiral phyllotaxy. A distichous habit is strongly emphasized in fossil impressions which have been subjected to more or less compression, just as it is in the case of pressed herbarium specimens.

There is a suggestion in some specimens of *Nageiopsis* that the base was markedly decurrent as in the modern *Araucaria bidwilli*. This is furnished by the extraordinarily large size of some of the stems, which are irregularly expanded and contracted as if certain of the decurrent leaf bases had been spread out somewhat in the flattening which accompanied fossilization. This feature is especially well shown in the portion of the specimen of *Nageiopsis zamioides* figured (fig. 1). The stem is broad at the base, giving off on either side subopposite leaves with apparently sheathing decurrent bases. Above their insertion the stem is considerably narrowed, passing to a portion obscurely preserved. Above this point it is at least twice as broad, contracting to form the narrow base of the right-hand leaf, while just above the main stem is continued as a much narrowed

twig, the next leaf above, that on the left, having its base concealed behind the twig. In no instance is the preservation as good as could be desired, so that the question can not be definitely settled, but such examples as that figured go a long way toward proving that at least some of the forms referred to *Nageiopsis* had strongly decurrent leaves and a spiral phyllotaxy. Similar features are shown in some of the specimens of *Nageiopsis angustifolia* and are indicated in the latest published figures of this species.^a

Fourteen supposed species have been described from the Potomac group, an additional one from the Kootanie, and Professor Seward recognizes a species in the English Wealden and doubtfully records a representative from the inferior Oolite of Yorkshire. The genus is also possibly represented in the Neocomian of Japan by specimens which have been identified as *Podozamites*, but this is far from being demonstrable.

The Potomac species, excluding those fragmentary species which are not here recognized as related to *Nageiopsis*, fall naturally into three species characterized, respectively, by the possession of very long linear leaves, very narrow lanceolate leaves and ovate-lanceolate leaves.

They are especially characteristic of the Patuxent formation, in fact the bulk of the unequivocal material comes from the single locality at Fredericksburg, Virginia. They evidently survived the close of the Patuxent, however, characteristic specimens of *Nageiopsis angustifolia* occurring in the lower beds at Federal Hill in Maryland, and at various Patapsco outcrops in Virginia.

Regarding the botanical affinity of *Nageiopsis*, Professor Fontaine has repeatedly pointed out its striking resemblance to *Podocarpus*. While admitting this resemblance both Nathorst and Seward have suggested *Araucaria* for comparison.^b Although there is, for example, considerable similarity between *Nageiopsis zamiioides* and *Araucaria bidwilli*, where in the genus *Araucaria* is there an analogue of *Nageiopsis longifolia*? In addition the *Araucariæ* have their leaves much crowded and the phyllotaxy is spiral while in *Nageiopsis* the leaves are much more remote and the evidence for a spiral phyllotaxy is not entirely conclusive although probable. *Araucaria* has markedly decurrent leaves and this character also can not be demonstrated

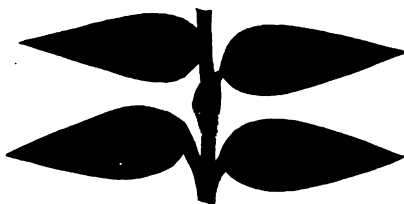


FIG. 1.—FRAGMENT OF A TWIG OF *NAGEIOPSIS ZAMIIOIDES* SHOWING INDICATIONS OF DECURRENT LEAVES AND A SPIRAL PHYLLOTAXY. NATURAL SIZE, BUT SOMEWHAT EXAGGERATED.

^a Monogr. U. S. Geol. Surv., No. 48, 1906, pl. 117, figs. 4, 5.

^b This is probably the true affinity of Seward's Lower Oolite *Nageiopsis*. Jurassic Flora, pt. 1, 1900, p. 288, pl. 51.

for *Nageiopsis* although, as the writer shows elsewhere in this paper, there is some evidence for both this and the preceding character in some of the specimens. Taking into account all of the facts obtainable, however, the reference of *Nageiopsis* to the *Podocarpeæ* seems reasonably well established, at least the facts at our command do not warrant our making any changes at the present time although the possibility of *Nageiopsis* being related to the abundant Mesozoic *Araucariæ* should not be lost sight of.

The existing species of *Podocarpus* comprise about two score forms and they are as dominant representatives of the Coniferales in the Southern Hemisphere as are the pines in the Northern. They extend northward to China and Japan through the East Indian region and have representatives in all three of the great southern land masses. This peculiar distribution in itself may be considered as an indication of an extensive geological history, although the records of this history are not nearly as complete as they are for many other genera. To summarize briefly there are fifteen or more described species coming chiefly from the European Tertiary and one of these has been doubtfully recognized by Lesquereux in this country at Florissant, Colorado. The extra-American distribution includes Eocene species in England, Scotland, France, Italy, and Australia; Oligocene species in France, Germany, Switzerland, Italy, Styria, Tyrol, and Greece; Miocene species in France, Styria, and Croatia; and Pliocene species in Italy. The descendants of *Nageiopsis* have not, however, been recognized in later American deposits.

The comparison of *Nageiopsis* with *Podocarpus* is more especially with the section *Nageia*, one of the four sections into which Eichler^a divides *Podocarpus*. *Nageia*, formerly regarded as a distinct genus, has a broad form, numerous parallel veins, and lacks a midrib, the latter being present in the other three sections of the genus. It may be questioned whether the reduction of Gaertner's genus to a section of *Podocarpus* L'Herétier, as clearly expresses the natural facts as they would be emphasized by its retention as a distinct genus. *Nageia* has about a dozen species ranging from Japan southward to the East Indies and New Caledonia.

It has seemed wiser in considering detached and fragmentary leaves such as are those specimens which have been referred to *Nageiopsis* from the Shasta, Lakota, and Kootanie formations to fully indicate their extremely doubtful character. Likewise in regard to the affinity of some of the fragmentary detached specimens of *Nageiopsis*, so called, from higher horizons in the Potomac group in cases where there is absolutely no evidence that they are so related they have been referred to *Podozamites* or *Zamites*, genera broad enough to include them without the implications and the contravention of the generic diagnosis which would be involved in retaining them in *Nageiopsis*.

^a In Engler and Prantl.

NAGEIOPSIS LONGIFOLIA Fontaine.^a

Nageiopsis longifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 195, pl. 75, fig. 1; pl. 76, figs. 2-6; pl. 77, figs. 1, 2; pl. 78, figs. 1-5; pl. 79, fig. 7; pl. 85, figs. 1, 2, 8, 9.—? FONTAINE, in Diller and Stanton, Bull. Geol. Soc. Amer., vol. 5, 1894, p. 450.—? FONTAINE, in Stanton, Bull. 133, U. S. Geol. Surv., 1896, p. 15.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 259, 311, 484, 491, 510, 528, 548, 557; pl. 68, figs. 9-12; pl. 73, fig. 9 (not pl. 45, figs. 1-5).—? KNOWLTON, in Diller, Bull. Geol. Soc. Amer., vol. 19, 1908, p. 386.

Angiopteridium strictinerve FONTAINE ? in Diller and Stanton, Bull. Geol. Soc. Amer., vol. 5, 1894, p. 450.—FONTAINE, in Stanton, Bull. 133, U. S. Geol. Surv., 1896, p. 15.

Nageiopsis crassicaulis FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 198, pl. 79, figs. 2, 6; pl. 82, fig. 1; pl. 84, figs. 3, 9, 11.

Description.—Branching leafy twigs of large size, stout and thick, apparently branched in approximately one plane. Leaves linear-lanceolate, often slightly curved, somewhat inequilaterally narrowed into a short slightly twisted petiole; above gradually narrowed to the acute or subacute tip. Length, 8 to 20 cm.; width, 5 mm. to 1.3 cm. The leaves are not crowded and usually appear opposite or subopposite, as if inserted on the lateral margins of the stem, although at times they seem to be attached to its upper or lower side. As previously remarked, none of the material is conclusive in regard to the phyllotaxy. Veins nine to twelve in number, usually ten, forking only at the base and running parallel until they abut against the leaf margin, about 0.7 mm. apart, somewhat coarser in caliber than in the other members of the genus, distinct on both surfaces of the lamina and apparently not immersed. Leaf substance not coriaceous.

This species is quite distinct from its congeners, and the great development of its evergreen foliage must have rendered it a most striking object in life.

Included under this species are the few and rather poor remains upon which Fontaine founded *Nageiopsis crassicaulis*. All but one of the specimens which that author so names are fragments of detached leaflets, somewhat shorter and broader than the typical leaves of *Nageiopsis longifolia*, but absolutely uncharacteristic and incapable of identification. The specimen with leaves attached is obviously a poorly preserved fragment of a twig of *Nageiopsis longifolia*.

This species occurs abundantly in characteristic and fine specimens at Fredericksburg. It has also been recorded from a large number

^a *Irites alaskana* Lesquereux is made a synonym of this species in Monograph 48. According to the principles so often set forth by Professor Ward, this species should be renamed if *Irites alaskana* is included in it, since the latter was published three years before *Nageiopsis longifolia*. As the Alaska remains are not those of a *Nageiopsis* this name is omitted from the synonymy.

of localities in Virginia and Maryland, mostly as detached specimens, generally with the base and apex missing, so that the record of its range is somewhat unreliable, nor can it be otherwise from the nature of the material. These doubtful occurrences are indicated by a query in the table of distribution.

Professor Fontaine has recorded this species from Cape Lisburne, Alaska; from several Californian localities referred to the Shasta group; from the Kootaine formation at Geyser, Montana, and from the Lakota formation in the Western Black Hills, at Barrett, Wyoming. Referring to these very briefly, it may be said that the Alaska locality is much older than any of the others, and the fossils referred to this species, previously identified by Lesquereux as *Irites alaskana* Lesquereux and *Baiera palmata* Heer, are entirely uncharacteristic, and, in the writer's judgment, are in nowise related to *Nageiopsis*. The Shasta records are based entirely on small fragments, which show only the middle portion of leaves and often lack the venation. The following quotation from Fontaine's report (1905, p. 259) sufficiently indicates their reliability: "The presence of *N. longifolia* in the flora of the Shasta formation can not be positively determined from the specimens found."

The Kootaine record is likewise extremely doubtful, and is based on five or six fragments from Geyser which are unattached and show neither bases nor tips. The specimens reported from the Lakota formation are also all fragmentary and uncharacteristic, and while we would expect to find this species in the west, the nature of the remains thus far collected scarcely justifies the identifications which have been based upon them, and as furnishing facts for stratigraphic correlation they are absolutely valueless.

Occurrence.—PATUXENT FORMATION. Dutch Gap, Kankeys, Cockpit Point, Telegraph station (Lorton), Virginia. ARUNDEL FORMATION. Langdon, District of Columbia. PATAPSCO FORMATION. Near Brooke, Mount Vernon, Deep Bottom (?), Chinkapin Hollow (?), Virginia; Fort Foote, Federal Hill, Vinegar Hill (?), Maryland. (?) LAKOTA FORMATION. Barrett, cliff on north side of valley of South Fork of Hay Creek, Wyoming. (?) KOOTAINE FORMATION. Geyser, Montana. (?) SHASTA FORMATION. Knoxville and Horsetown beds, Tehama County, California.

NAGEIOPSIS ANGUSTIFOLIA Fontaine.

Nageiopsis angustifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 202, pl. 86, figs. 8, 9; pl. 87, figs. 2-6; pl. 88, figs. 1, 3, 4, 6-8; pl. 89, fig. 2.—FONTAINE, in Ward, 19th Ann. Rept. U. S. Geol. Surv., pt. 2, 1899, p. 684, pl. 168, fig. 7.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 219, 491, 516, 528, 560, pl. 117, figs. 4, 5.

Description.—Much branched stems, of comparatively large caliber. Leaves variable in size, becoming smaller on ultimate twigs, but con-

stant in their proportions; very long and narrow, linear-lanceolate, sometimes somewhat falcate, acute, averaging about 3 mm. in width, in some instances only 1.5 mm. wide, greatest width observed 4 mm.; length 2 to 7 cm., averaging about 5 cm.; veins of fine caliber, generally eight in number, sometimes observed to fork at the base. An abundant species suggestive of *Cephalotaxopsis* in general appearance, but perfectly distinct and easily distinguished by the stomatal grooves of the latter.

Occurrence.—PATUXENT FORMATION. Fredericksburg, near Dutch Gap, near Potomac Run, Virginia; Sixteenth street, District of Columbia. ARUNDEL FORMATION. Bay View, Maryland. PATAPSCO FORMATION. Near Brooke, Mount Vernon, Virginia; Federal Hill, Fort Foote, Fort Washington (?), Maryland. (?) LAKOTA FORMATION. Barrett, Crook County, Wyoming. (?) SHASTA FORMATION.

NAGEIOPSIS ZAMIOIDES Fontaine.

Nageiopsis zamioides FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 196, pl. 79, figs. 1, 3; pl. 80, figs. 1, 2, 4; pl. 81, figs. 1-6.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 510, 521, 528, 545.

Nageiopsis recurvata FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 197, pl. 75, fig. 2; pl. 79, fig. 4; pl. 80, fig. 3.

Nageiopsis decrescens FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 199, pl. 77, fig. 3.

Nageiopsis ovata FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 199, pl. 77, fig. 4; pl. 80, fig. 5.

Nageiopsis heterophylla FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 201, pl. 84, fig. 4; pl. 86, figs. 6, 7; pl. 88, figs. 2, 5.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 219 (?), 483, 520, 548, 561, pl. 117, fig. 6.

Nageiopsis microphylla FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 201, pl. 84, fig. 6; pl. 85, fig. 14; pl. 86, figs. 1-3, 5.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1905, p. 484.

Nageiopsis cf. *N. heterophylla* FONTAINE, Seward, Wealden Flora, pt. 2, 1895, p. 211, pl. 12, fig. 3.

Description.—Leaves ovate-lanceolate, proportionately shorter and wider than in *N. angustifolia* and much shorter and more rounded in outline than in *N. longifolia*, broadest toward the rounded base, the maximum width observed being 1.5 cm., although the average width is much less and may be put at 1 cm. or slightly less; very variable in size, tip generally acute, although an occasional specimen may be obtuse. The greatest length observed is 8 cm., but the average length is much less than this, and may be placed at 3 cm. to 4 cm. Occasional twigs like the solitary specimen described as *N. decrescens* or the specimens referred to *N. microphylla* may be much smaller than the above; the latter are, however, of the same general shape, while in the former case the fact that the larger leaves at the base of the specimen are replaced by very minute leaves indicates that the specimen is an abnormal twig. Veins fine in caliber, somewhat remote, generally six to nine in number, forking at the base

and diverging rapidly at first, then parallel until they abut upon the margin.

While it might seem at first sight that too great a variety of leaf forms had been lumped under this specific name, the great variability of the leaves on single twigs should be kept in mind. The leaves in the type forms are commonly smallest toward the base of the twigs, as they are also in the *N. ovata* forms. In *N. decrescens* the basal leaves are one hundred per cent longer than are the succeeding leaves. In the forms described by Fontaine as *N. heterophylla* the leaves are especially variable, some being identical with those he called *N. microphylla*, while others are like those he calls *N. decrescens*, others still simulating his *N. ovata* and *N. zamioides* with two or more of these types present on the same twigs. Others referred by him to *N. zamioides* show an equally wide range of variation. I have figured (fig. 2) a specimen labeled *N. zamioides* which shows but five leaves,



FIG. 2.—TWIG OF NAGEIOPSIS ZAMIOIDES SHOWING VARIATION IN FORM AND SIZE OF LEAVES.

and includes leaves easily referable to his species *microphylla*, *decrescens*, *ovata*, *heterophylla*, and *zamioides*, leaving only his *N. recurvata* to be accounted for. Since these latter are detached, there is really no proof that they are correctly identified. They are, however, exactly like certain somewhat falcate leaves of *N. zamioides* found on twigs among normally straight leaves, so that there is little doubt but that the Virginia specimens are referable to this species. The form identified as *N. recurvata* from Vinegar Hill, Maryland, is different from the others and is a *Podozamites* leaflet. Corroborate

evidence is furnished by the similarity in venation characters and in the fact that all but one of the six so-called species, *N. decrescens*, are from the single limited exposure at Fredericksburg, and this was described from a near-by and probably synchronous outcrop and is really present at Fredericksburg attached to a twig labeled *N. heterophylla*. Four of them are again associated at the Dutch Gap locality. Again at Fredericksburg the typical *zamioides* of Fontaine are very abundant, while the variants which he described as separate species are represented in some cases by a single specimen, in others by but two or three specimens. I think a glance at the various figures in Fontaine's monograph and a perusal of the accompanying descriptions will be convincing, and this is only emphasized by a consultation of the specimens themselves.

Compare, for example, fig. 5 of *ovata* with fig. 3 of *zamioides* and it will be seen that they might have been drawn from the same specimens. This is likewise true when the single specimen of *N. decresceus* is

compared with fig. 3 and fig. 6 of *N. microphylla*, and similar comparisons can be made back and forth indefinitely.

Seward^a describes and figures a few small fragments from the English Wealden at Hastings and Ecclesbourne, which he compares with *N. heterophylla* Fontaine. The specimen figured shows well the branching habit, and as near as can be judged, is a species of *Nageiopsis*. Since, however, the name *N. heterophylla* Fontaine becomes a synonym of *N. zamioides* Fontaine, the English fossils may be given the latter name without question, it seems to me.

Occurrence.—PATUXENT FORMATION. Fredericksburg, Dutch Gap, Cockpit Point, near Potomac Run, Virginia. ARUNDEL FORMATION. Langdon, District of Columbia; Bay View, Hobb's Iron Mine (?), Maryland. PATAPSCO FORMATION. Vinegar Hill, Overlook Inn Road, Maryland. (?) SHASTA FORMATION. Tehama County, California.

It remains to notice several forms described as species of *Nageiopsis* and which are obviously not related to that genus. The first to be considered is *Nageiopsis acuminata* Fontaine, founded on a single detached leaf from near Telegraph Station, Virginia. Professor Fontaine's figure is quite accurate in outline and the veins are very distinct although he says "veins not seen;" they number about twenty and are thus more numerous than in *Nageiopsis*, besides being coarser and more distinctly immersed. This leaf appears to be identical with the leaflets of *Podozamites acutifolius* of the same author, some specimens of which have been found at this same locality.

Another form, named *N. subfalcata* by Professor Fontaine, is also based on a single imperfect specimen which came from near Dutch Gap, Virginia. As figured and described it presents no characters by which it can be recognized and none which ally it with *Nageiopsis*. The writer has been unable to locate this specimen in the National Museum collections. Professor Fontaine says of it: "Its position is doubtful, and it may be a *Sequoia*, for the footstalks seem to be decurrent. They leave imprints on the stem resembling those of *Sequoia*." It is extremely probable that this specimen should be referred to *Sequoia*, as Fontaine suggests.

^a Wealden Flora, pt. 2, 1895, p. 211, pl. 12, fig. 3.

PODOZAMITES INÆQUILATERALIS (Fontaine), new combination.

Nageiopsis obtusifolia FONTAINE,^a Monogr. U. S. Geol. Surv., No. 15, 1890, p. 200, pl. 85, fig. 7.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1906, p. 484.

Nageiopsis inæquilateralis FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 200, pl. 85, fig. 6.

Nageiopsis montanensis FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1906, p. 312, pl. 73, fig. 7.

The description of *N. inæquilateralis* is an alliteration of that of the preceding *N. obtusifolia*. It is based on a single specimen. Veins are twenty-two in number, much thicker than in *Nageiopsis* and like those in *N. acuminata*, which has already been referred to *Podozamites*. They converge toward the tip of the leaf, which is missing in the specimen. Leaf pedicellate at base.

N. montanensis, from the Kootanie at Geyser, Montana, is based on a single detached leaflet with nineteen or twenty veins, convergent in the obtuse tip. There is absolutely no ground for including it in *Nageiopsis*. The *inæquilateralis* specimen comes from Kankeys, Virginia, and *obtusifolia* was found near Potomac Run and at Cockpit Point, Virginia.

These imperfect forms are suggestive of *Podozamites affinis* (Schenk) Schimper of the Wernsdorfer schichten, but are not representative enough for accurate comparison.

Occurrence.—PATUXENT FORMATION. Kankeys, Cockpit Point, near Potomac Run, Virginia. KOOTANIE FORMATION. Geyser, Montana.

PHYLLITES LATIFOLIUS (Fontaine), new combination.

Nageiopsis latifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 198, pl. 82, fig. 3.—FONTAINE, in Ward, Monogr. U. S. Geol. Surv., No. 48, 1906, p. 260, pl. 68, fig. 13.

Description.—"Leaves very broad and short, base and apex not seen; leaf-substance thin; shape of leaves probably broadly elliptical; nerves not fully disclosed, but probably branching near the base; they are then approximately parallel to near the apex, following the margins, and parallel." Fontaine, 1890.

This species was based on several detached leaves, from near Dutch Gap Canal and Potomac Run, none of which show base, apex, general form, or method of attachment, the most complete one found being the one figured. They present no characters which ally them to *Nageiopsis*, from which they are excluded by their deciduous nature. The single specimen which Fontaine identifies as this species from

^a The specific name *obtusifolia* can not be used for a species of *Podozamites*, as there has been quasi use of this combination by Heer: Handl. Königl. Sven. Vet. Akad. (Fl. Foss. Arct., vol. 4, pt. 1), 1876, p. 39, pl. 8, fig. 6.

the Shasta is equally unsatisfactory, and judging by the analogies furnished by the existing *Podocarpeæ* it seems extremely unlikely that conifers of the *Nageiopsis* type should have included such broad-leaved forms.

They are possibly referable to some of the large-leaved *Cycadaceæ* of the Lower Cretaceous, Professor Fontaine suggesting their possible reference to *Podozamites* (cf. *grandifolius* Fontaine). They may also be compared to conifers of the *Dammara* type, but the material collected up to the present time is incapable of throwing any light on their true botanical affinity.

Occurrence.—PATUXENT FORMATION. Near Dutch Gap, near Potomac Run, Virginia. (?)SHASTA FORMATION. Near Riddles, Oregon.

ON A COLLECTION OF TENTHREDINOIDEA FROM EASTERN CANADA.

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The following is a report of an interesting collection of Tenthredinoidea made mostly in the county of St. John, New Brunswick, by Mr. A. Gordon Leavitt, and sent to the U. S. National Museum. All the collection having been made in eastern Canada came from either the Canadian or Hudsonian Life Zone, and contains species found throughout these zones. Of the 22 genera all but 6 are Holarctic, and perhaps most of these occur in the Palearctic, but have not yet been recognized by European workers.

Some of the generic names used in the following paper have not been used heretofore in connection with Nearctic species, and the conception of some of the genera is different from that usually held; but in all cases of inconsistency with the standard works an effort has been made to show that the present view is correct. All species referred to the following genera are believed to be congeneric with the type of each genus.

Family TENTHREDINIDÆ.

Subfamily ARGINÆ.

Genus ARGE Schrank.

ARGE BOREALIS (Kirby).

Female, Nerepis, New Brunswick, July 22.

This specimen is somewhat paler than the type, but the structure is as described in my notes from the type in the British Museum.

ARGE MACLEAYI (Leach).

Female, Nerepis, New Brunswick, July 24.

Under this name there seems to be a number of distinct forms, but this specimen is typical.

Subfamily NEMATINÆ.

Genus PTERONUS Jurine.

PTERONUS ANTENNATUS Marlatt.

Female, Nerepis, New Brunswick, August 19.

PTERONUS RUFOCINCTUS (Harrington).

Female, St. John, New Brunswick, June 14.

Only the three apical segments are black, and the insect is somewhat smaller, but is undoubtedly Harrington's species.

PTERONUS OCHREATUS, new species.

Belongs to the group of *mendicus*, but is distinct in the poorly defined ocellar basin, and characters in the saw.

Female.—Length, 5.5 mm. Clypeus broadly, semicircularly emarginate; middle fovea small, nearly circular, and not very distinct; ocellar basin very poorly defined, better defined above; frontal crest broken by a very shallow depression; antennal foveæ large and extending a little above the crest; furrow above anterior ocellus extending beyond the ocellar line; the interocellar furrow wanting; third and fourth antennal joints equal; stigma rather narrow, gently rounded, apex sharply rounded; third cubital but little wider at the apex; lower discal cell of hind wings a little shorter than the upper; sheath robust at base, sharply pointed at apex; saw stout at base, tapering to an acute tip, with sharp teeth both above and below. Reddish-yellow; interocellar area, elongate spots on lateral lobes, metanotum, basal plates and most of tergum black. Wings slightly yellowish hyaline, vitreous; venation brown, costa and stigma, except base, yellowish. Basal two joints of antennæ and the third and fourth joints above brown, the rest of the antennæ the color of the body.

Type-locality.—St. John, New Brunswick. One female collected on July 14 by Mr. A. G. Leavitt.

Type.—Cat. No. 12922, U.S.N.M.

Genus PONTANIA O. Costa.

PONTANIA PUMILA, new species.

Belongs to Group II of Marlatt (Revision of Nematinae of North America) and is related to *kincaidi* Marlatt, but is smaller, the ocellar basin is wanting, and there are other differences.

Female.—Length 4 mm. Clypeus broadly, shallowly, semicircularly emarginate; supraclypeal area convex; antennal foveæ angled above; middle fovea rather shallow, elongate; ocellar basin wanting; interocellar furrow wanting; scutellar appendage dull, finely sculp-

tured; stigma rounded on the lower margin, broader a little basad of middle; upper discal cell a very little longer than lower; sheath straight above, rounded at apex beneath; saw hyaline, with poorly defined teeth and transverse ridges. Black; mandibles (apices piceous), labrum, apex of clypeus, angles of pronotum broadly, tegulæ, legs below middle of coxæ, and venter of abdomen whitish or reddish-yellow. Wings hyaline; venation brown.

Male.—Very like the female, but the clypeus is more deeply emarginate. The hypopygidium is long and narrowed at the apex, which is rounded.

Type-locality.—St. John, New Brunswick. One female collected on July 14 by Mr. A. G. Leavitt. The male was collected by Mr. Leavitt, July 22, at Nerepis, New Brunswick.

Type.—Cat. No. 12920, U.S.N.M.

PONTANIA LEAVITTI, new species.

Belongs to Group I of Marlatt^a and seems to be nearest to *P. pallicomis* (Norton), but differs in the structure of the sheath, clypeus, and dark orbits.

Female.—Length, 4.5 mm. Clypeus deeply angularly emarginate, lobes sharply triangular; supraclypeal area strongly convex; middle fovea deep, rather large, circular; ocellar basin well defined, shining, hardly punctured; interocellar furrow well defined; head rather coarsely granular; third and fourth antennal joints subequal; anterior lobe of mesonotum rounded posteriorly, mesonotum dullish; scutellar appendage shining, highly polished; stigma gently rounded on lower margin; sheath broad at base, tapering above and below to an acute awl-like tip, emarginate beneath; saw with small teeth above and below. Black; clypeus, labrum, mandibles (apices piceous) supraclypeal area, angles of pronotum, tegulæ, coxæ, trochanters and anterior legs pallid; posterior orbits, posterior legs, and venter reddish-yellow. Wings hyaline, iridescent; venation dark brown, basal half of stigma pallid.

Type-locality.—Nerepis, New Brunswick. One female collected July 11 by A. G. Leavitt.

Type.—Cat. No. 12921, U.S.N.M.

Named in honor of Mr. A. Gordon Leavitt, who collected the material referred to in this paper.

Genus PRISTIPHORA Latrielle.

PRISTIPHORA IDIOTIFORMIS, new species.

Female.—Length, 5 mm. Very like *idioti* Norton, as determined by Marlatt, but differs as follows: Stigma and venation dark brown; abdominal segments 2 to 7 reddish-yellow; scutellar appendage shin-

^a Rev. Nematineæ of North America, Tech. Series No. 3, U. S. Dept. Agr., 1896.

ing, very finely sculptured, not distinctly granular; middle fovea more strongly defined but of the same type.

Male.—The male differs from the male of *idiota* in same characters as the female, but as in *idiota* has the abdomen black.

Type-locality.—Nerepis, New Brunswick. One female and two males, collected August 18 by Mr. A. G. Leavitt.

Paratype-locality.—Red Head, St. John, New Brunswick. One male collected September 1 by Mr. A. G. Leavitt.

Type.—Cat. No. 12923, U.S.N.M.

PRISTIPHORA IDIOTA Norton.

Male and female, Great Caribou Island, Labrador, July 27, 1906.

PRISTIPHORA DYARI Marlatt.

Female, Nerepis, New Brunswick, July 24.

This specimen differs from the type in having the upper part of the mesopleuræ and most of the anterior lobe of the mesonotum rufo-piceous. Structurally, however, it is the same.

PRISTIPHORA PALLICOXA, new species.

Related to *P. banksi* Marlatt, but has the legs and venter pale.

Female.—Length 5 mm. Antennal foveæ rather small, extending to about the middle of eyes; middle fovea small and indistinct; walls of the ocellar basin wanting; postocellar area narrow, much wider than long, poorly defined on all sides; front coarsely, irregular granular, posterior orbits finely so; third antennal joint distinctly longer than fourth; mesonotum finely sculptured, shining; scutellum longitudinally carinate; scutellar appendage shining, very finely sculptured; first transverse cubitus wanting; stigma broadest at base, gently tapering to apex; upper discal cell longer than lower; sheath broad at base, slightly concave above, apex rounded to meet the broadened base; cerci robust. Black; mandibles (apices piceous), palpi, labrum, apex of clypeus, angles of pronotum broadly, tegulæ, venter, legs, except the apices of hind femora and tibiæ whitish. Wings hyaline, iridescent; venation dark brown, except the pallid costa.

Type-locality.—Nerepis, New Brunswick. One female collected July 22 by Mr. A. G. Leavitt.

Type.—Cat. No. 12924, U.S.N.M.

Genus CRYPTOCAMPUS Hartig.

CRYPTOCAMPUS PALLISTIGMUS, new species.

Related to *C. brachycarpæ* Rohwer, but may be known by the rounded, not ridged, supraclypeal area, paler stigma, and more feebly tooth saw of the female.

Female.—Length 5 mm. Labrum strongly rounded at the apex; clypeus rather deeply semicircularly emarginate, lobes broadly triangular, rounded at the apex; supraclypeal area raised, rounded; middle fovea elongate, pointed toward the clypeus; antennal foveæ large, uniting with the supraclypeal foveæ; antennal furrow nearly complete, narrow; ocellar basin well defined, though the ridges are not sharp; interocellar furrow poorly defined; crest broken although not strongly so; third antennal joint very little longer than fourth; scutellar appendage irregularly punctured; cerci of median length, tapering apically; sheath straight above, rounded below; teeth of saw very small and weak; stigma slightly broader at base, sharply rounded at apex. Black; mandibles (apices piceous), most of clypeus, labrum, supraclypeal area, inner orbits to antennæ, posterior orbits to top of eyes (the orbits are dusky), legs (the tarsi dusky and femora brownish) reddish-yellow; extreme angles of pronotum and tegulæ pallid. Wings hyaline, iridescent; venation pale brown, stigma pallid.

Male.—Length 4 mm. Differs from the female as follows: Third antennal joint slightly shorter than fourth, flagel pale beneath, and stigma dark brown. Hypopygidium pale and sharply pointed. The male is easily separated from *brachycarpæ* by the pointed hypopygidium.

Type-locality.—St. John, New Brunswick. Three females and two males collected July 18 by Mr. A. G. Leavitt.

Type.—Cat. No. 12921, U.S.N.M.

Subfamily FENUSINÆ.

Tribe FENUSINI.

Genus FENUSA Leach.

In 1817 Leach^a described the genus *Fenusa* and named only *Tenthredo* (*Emphytus*) *pumila* Klug, which is therefore the type of the genus. In 1846 Tischbein^b in describing *dohrnii* referred it to a new genus *Kaliosyphinga*. *Dohrnii* is therefore the type of *Kaliosyphinga*, the genus originally being monobasic. *Kaliosyphinga dohrynii* Tischbein and *Tenthredo* (*Emphytus*) *pumila* Klug are congeneric, so the genera are the same. *Fenusa* is the older name.

Leach in the same paper^c described the genus *Messa* and named only *Tenthredo* (*Emphytus*) *hortulana* Klug, which is therefore the type of the genus. Konow^d does not include the genus *Messa*, but places its genotype in the genus *Fenusa* and the genotype of *Fenusa* in the genus *Kaliosyphinga*. The genus *Fenusa*, as defined by Konow,^e is *Messa* Leach, and *Kaliosyphinga* as treated by Konow^e and from the original description, is *Fenusa* Leach.

^a Zool. Misc., vol. 3, p. 126, n. 4.

^b Stettin Ent. Zeit., vol. 7, p. 79.

^c Zool. Misc., vol. 3, p. 126, n. 3, 1817.

^d Gen. Insect., 1905, fas. 29.

^e Idem, p. 89.

FENUSA DOHRNI (Tischbein).

Three females, Nerepis, New Brunswick, July 22, 24.

Tribe SCOLIONEURINI.**Genus POLYBATES MacGillivray.****POLYBATES SECUNDUS, new species.**

Differs from *P. slossonæ* MacGillivray in the circular (not elongate) middle fovea, the wings are more dusky and the stigma is shorter and angled at the base.

Female.—Length, 3 mm. Antennal foveæ large, sharply defined, not joining the small circular sharply defined lateral fovea; middle fovea small, circular, and well defined; supraclypeal area broadly rounded and spreading over the antennæ in low, rounded ridges; postocellar area broader at the occiput; interocellar furrow straight, ocellar line equal to the ocellocular line; flagellum punctured, hairy, the first joint a very little shorter than the second, the second and third equal; mesonotum with shallow, poorly defined punctures; legs and abdomen normal; saw of the same type as *slossonæ*; stigma but little more than twice as long as its greatest width, broader and somewhat angled at the base. Black; abdomen piceous; all of legs pale yellow; wings distinctly dusky, venation dark brown.

Type-locality.—Red Head, St. John, New Brunswick. Two females collected by Mr. A. G. Leavitt, September 1, 1907.

Type.—Cat. No. 12926, U.S.N.M.

Genus PARABATES MacGillivray.**PARABATES LEUCOSTOMUS, new species.**

Easily known by the white clypeus, labrum, mandibles and tegulæ.

Female.—Length, 3 mm. Area around the antennæ with small, irregular, poorly defined punctures; middle fovea rather large, circular and not sharply defined; antennal foveæ not sharply defined and not joining with the elongate lateral, frontal fovea; anterior ocellus at the apex of the flattened ocellar area; antennal furrows above the ocelli punctiform; interocellar furrow poorly defined; post ocellar line equal with the ocellocular line; third antennal joint about a third longer than the fourth, the fourth and fifth equal; stigma rounded on the lower margin, broadest in the middle; saw without strong teeth, the lower part with distinct ribs, upper part normal. Black; clypeus, labrum, basal half of mandibles, angles of pronotum and tegulæ white; legs below knees brownish white; wings dusky hyaline, iridescent; venation dark brown.

Type-locality.—St. John, New Brunswick. One female collected July 11, by Mr. A. G. Leavitt.

Type.—Cat. No. 12925, U.S.N.M.

Subfamily SELANDRINÆ.

Genus ANEUGMENUS Hartig.

Type.—*Tenthredo* (*Emphytus*) *coronata* Klug.

This genus may be separated from *Selandria* Leach by the absence of a cephal-caudad suture on the upper part of the mesoepisternum, and by the anal cell of the hind wings being longer than the median on the median nervure.

ANEUGMENUS FLAVIPES (Norton).

Six females, Nerepis, New Brunswick, July 18, 22; female, St. John's Bay, July 18.

Genus STRONGYLOGASTER Dahlbom.

STRONGYLOGASTER TACITUS (Say).

Two males, Nerepis, New Brunswick, August 9, 22.

STRONGYLOGASTER SORICULATRIPESS (not Provancher).

Female, Nerepis, New Brunswick, July 22.

Subfamily EMPHYTINÆ.

Genus EMPHYTUS Klug.

EMPHYTUS APERTUS Say.

Female, Nerepis, New Brunswick, August 18.

EMPHYTUS MELLIPES Norton.

Two females, Nerepis, New Brunswick, August 18, 20.

Genus ERMILIA O. Costa.

=*Hypotaxonus* ASHMEAD, Can. Ent., p. 311, 1898.

The type of *Ermilia* is *Ermilia pulchella* O. Costa which is conspecific with *Tenthredo agrorum* Fallén. In 1898 Ashmead^a described the genus *Hypotaxonus* and named as the type *Strongylogaster pallipes* Say. *Tenthredo agrorum* Fallén and *Strongylogaster pallipes* Say are congeneric so *Hypotaxonus* Ashmead must be considered as a synonym of *Ermilia* O. Costa.

ERMILIA PALLIPES (Say).

Female, Nerepis, New Brunswick, July 22.

^aCan. Ent., p. 311.

Genus **APHILODYCTIUM** Ashmead.

= *Parataxonus* MAC GILLIVRAY, Can. Ent., 1908, p. 367.

Strongylogaster rubripes Cresson and *Taxonus multicolor* Norton are congeneric so *Parataxonus* Mac Gillivray (1908) is a synonym of *Aphilodyctium* Ashmead (1898).

APHILODYCTIUM MULTICOLOR (Norton).

Four females, July 11, at St. John's Bay, New Brunswick; female, Nerepis, New Brunswick, July 22.

The first transverse cubitus is wanting in two of the specimens.

Genus **HEMITAXONUS** Ashmead.**HEMITAXONUS RUFOPECTUS**, new species.

Readily distinguished from either of the American species by its entirely different color, and long slender antennæ.

Female.—Length, 7.5 mm. Anterior margin of the clypeus gently, semicircularly emarginate, the lateral angles rounded; head below the crest and surface of the clypeus irregularly granular, the rest of the head and thorax shining, polished; ocellar basin nearly heart-shape, the anterior ocellus being in the smaller end; lateral frontal basins better defined than usual; post-ocellar area sharply defined all the way around; middle fovea elongate and nearly breaking through the crest; antennæ almost as long as the body, third joint slightly shorter than the fourth; legs and thorax normal; sheath rounded on the lower margin; third cubital cell slightly longer than the second, the transverse radius received near the apex. Black; clypeus, palpi, angles of the pronotum, tegulæ, basal fourth of the hind tibiæ, and a band on the hind basitarsis white; most of mesopleuræ, pectus, three basal abdominal segments (not basal plates) rufo-ferruginous; femora, four anterior tibiæ and tarsi except the paller color at the joints ferruginous; wings hyaline, iridescent; venation black.

Type-locality.—Nerepis, New Brunswick. One female collected August 22 by Mr. A. G. Leavitt.

Type.—Cat. No. 12928, U.S.N.M.

HEMITAXONUS ALBIDOPICTUS (Norton).

Male, Nerepis, New Brunswick, July 11.

Genus **MONSOMA** MacGillivray.**MONSOMA MAURA**, new species.

Very like *infernata* (Norton), but the supraclypeal area is not sharply ridged, the female is colored like the male and the sculpture of the head is different.

Female.—Length 6 mm. Anterior margin of the clypeus tridentate, the inner tooth smaller; head finely granular, the postocellar

area shining, with distinct punctures; supraclypeal area rounded, but not carinated; antennal furrows distinct, not curving so strongly to the orbits as in *infernata*; furrow from the anterior ocellus distinct, extending both above and below; postocellar furrow not sharply defined; third antennal joint distinctly longer than the fourth, fourth and fifth subequal; dorsulum and scutellum shining, irregularly finely sculptured; scutellar appendage highly polished; first transverse cubitus wanting; sheath rather narrow, and sharply truncate at the apex. Black; most of the clypeus, labrum, angles of pronotum and tegulæ pallid; four anterior femora and tibiæ beneath and base of posterior tibiæ dusky pallid; narrow apical margin of ventral segments pale. Wings dusky-hyaline, iridescent; venation dark brown.

Male.—Similar to the female; the clypeus is black and the apical margin almost truncate; the scutellar appendage is finely granular.

Type-locality.—Nerepis, New Brunswick. One female collected July 18, by Mr. A. G. Leavitt. One male, which is described as the male, was collected July 14 at St. Johns Bay, New Brunswick, by Mr. A. G. Leavitt.

Type.—Cat. No. 12927, U.S.N.M.

Genus **MACREMPHYTUS** MacGillivray.

MACREMPHYTUS TARSATUS (Say).

Female, St. John, New Brunswick, July 17.

Genus **DIMORPHOPTERYX** Ashmead.

DIMORPHOPTERYX MELANOGNATHUS, new species.

Readily separated from *D. pinguis* (Norton) by the black labrum, mandibles, antennæ and apex of abdomen.

Female.—Length 7 mm. Emargination of the clypeus angular; front irregularly granular-punctate, behind the supraorbital line and posterior orbits are shining, with ill-defined punctures; antennal foveæ large, extending above the middle of the eyes; ocellar basin well defined, but not sharply, joining with the middle fovea below; postocellar area convex; interocellar furrow wanting; first flagellar joint almost as long as second and third, the joints not so strongly constricted basally as in *pinguis*; mesonotum shining, with large punctures, the lateral lobes more sparsely so; pleuræ as in *pinguis*; sheath very stout, obliquely truncate at the apex. Black; four basal abdominal segments, basal half (or more) of the posterior femora and tibiæ rufo-ferruginous; four anterior legs and posterior tarsi reddish-white. Wings iridescent, hyaline, slightly dusky; venation dark brown.

Type-locality.—Nerepis, New Brunswick. One female collected July 22, by Mr. A. G. Leavitt.

Type.—Cat. No. 12929, U.S.N.M.

Genus STRONGYLOGASTEROIDEA Ashmead.**STRONGYLOGASTEROIDEA TERMINALIS (Say).**

Female, Nerepis, New Brunswick, July 11.

Subfamily DOLERINÆ.**Genus DOLERUS Jurine.****DOLERUS APRILIS Norton.**

Many males and females, Nerepis, New Brunswick, July 11, 22.

The tegulæ in two of the specimens are ferruginous. The sculpture of the scutellar appendage varies in this lot and it may be that there is more than one form, however, they are all *aprilis* as understood by Norton.

DOLERUS SIMILIS Norton.

Nine females, July 22, 24.

In these specimens the color of the pronotum and the anterior lobe of the mesonotum is subject to variation. The pronotum in some is very dark and the anterior lobe of the mesonotum rufo-ferruginous, or the pronotum may be rufo-ferruginous and the anterior lobe of the mesonotum mostly dark brown.

Subfamily TENTHREDINÆ.**Genus BIVENA MacGillivray.****BIVENA DELTA (Provancher).**

Female, Nerepis, New Brunswick, July 18.

Genus PACHYPROTASIS Hartig.**PACHYPROTASIS OMEGA Norton.**

Female, St. John, New Brunswick, July 14; male, Nerepis, New Brunswick, July 18.

It has been suggested that this species is the same as the European *rapæ* Linnæus, but as there seem to be differences in the hypopygium, therefore it seems best to keep them separate until a complete revision of the genus is possible. There is also a probability that there is more than one species under the name *omega*.

Genus MACROPHYA Dahlbom.**MACROPHYA VARIA Norton.**

Two females, St. John, New Brunswick, June 14.

These differ from Norton's description in having the spot on the posterior coxæ white instead of rufous, and the basal plates are entirely black.

MACROPHYA TRISYLLABA Norton.

Two females, St. John, New Brunswick, July 14; female Nerepis, New Brunswick, August 19.

Under the name *trisyllaba* there seems to be more than one species, and the above specimens are not typical, but until the type has been examined no satisfactory conclusion can be reached.

MACROPHYA FLAVICOXE Norton.

Eight females, St. John, New Brunswick, June 14 to July 22.

Genus LABIDIA Provancher.**LABIDIA ORIGINALIS (Norton).**

Female, Cape Charles, Labrador, July 22.

Genus ALLANTUS Jurine.**ALLANTUS BASALARIS Say.**

Ten females, Nerepis, New Brunswick, August 9-19; two females, St. John, New Brunswick, September 9.

Genus TENTHREDO Linnæus.**TENTHREDO GRANDIS Norton.**

Female, Nerepis, New Brunswick, June 19.

TENTHREDO SEMIRUBRA Norton.

Male, Nerepis, New Brunswick, August 19.

This species was described from females collected in Massachusetts, but the above male can well be referred to this species. Specimens of the same species have been collected at Florissant, Colorado.

TENTHREDO LINEATA Provancher.

Two females, St. John, New Brunswick, July 18.

TENTHREDO MELLINA Norton.

Female, var. Nerepis, New Brunswick, August 18; male, var. Nerepis, New Brunswick, July 22.

The male has the pleuræ and pectus yellow.

TENTHREDO RUFOPECTUS Norton.

Female, St. John, New Brunswick, June 14; female, Nerepis, New Brunswick, August 18.

TENTHREDO RUFIPES Say.

Three females, St. John, New Brunswick, July 14; three females, Nerepis, New Brunswick, July 22.

These represent a variety with the tegulæ and collar yellow.

TENTHREDO DIVERSICEPS, new species.

Very like *Tenthredo titusi* Rohwer and *T. divergens* Rohwer. The following characters separate it from *divergens* and many of them may be used in separating it from *titusi*: Markings white; posterior tibiæ black except basal half; pedicel twice as long as wide at apex; third antennal joint as in *titusi*; ocellar basin sharply defined and confluent with the middle fovea; hypopygidium obtusely pointed at apex, not broadly rounded.

Type-locality.—Nerepis, New Brunswick. One male collected July 22, by Mr. A. G. Leavitt. At St. John, Mr. Leavitt collected a male which is referred to this species with doubt.

Type.—Cat. No. 12930, U.S.N.M.

TENTHREDO OBLIQUATUS MacGillivray.

Seven males, Nerepis, New Brunswick, July 18.

TENTHREDO SEMICORNIS Haglington.

Male, St. John, New Brunswick, July 14.

TENTHREDO VERTICALIS Say.

Two females, Nerepis, New Brunswick, July 22.

TENTHREDO ANGULIFERA Norton.

Female, Nerepis, New Brunswick, July 22.

Subfamily CIMBICINÆ.**Genus Cimbex Oliver.****CIMBEX AMERICANA Leach.**

Typical form.—Two males, St. John, New Brunswick, July 11, 14.

Var. *decemmaculatus* Leach. Female, Nerepis, New Brunswick, August 9.

Family CEPHIDÆ.**Genus ADIRUS Konow.****ADIRUS TRIMACULATUS (Say).**

Male, St. John, New Brunswick, July 14.

Family SIRECIDÆ.**Subfamily SIRECINÆ.****Genus SIREX Linnæus.****SIREX CRESSONI Norton.**

Female, Nerepis, New Brunswick, August 18.

In this specimen the antennæ are nineteen-jointed and the apical joints are somewhat compressed.

SIREX FLAVICORNIS Fabricius.

Female, Hopedale, Labrador, August 1, 1908.

Genus PAURURUS Konow.**PAURURUS CYANEUS (Fabricius).**

Two females, St. John, New Brunswick, September 23 and October 3.

The specimen taken in October is noticeably smaller.

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ON THE ORIGIN OF CERTAIN TYPES OF CRINOID STEMS.

By AUSTIN HOBART CLARK,

Assistant Curator, Division of Marine Invertebrates, U. S. National Museum.

In a recent number of the *American Naturalist*^a I brought forward what appears to me to be conclusive evidence of the very close relationship between the Echinoidea and the Crinoidea, which two groups I placed, together with the Holothuroidea, in the new sub-phylum Echinodermata Heteroradiata in contradistinction to the Echinodermata Astoradiata, which comprises the Asteroidea and the Ophiuroidea. The paper was necessarily short; only the major features of the interrelationships were considered, as in a dissertation of that character wealth of detail always means lack of strength; and many minor points connected with the homology in whole and in part between the urchins and the pelmatozoa yet remain to be elucidated. One of the most important of these minor considerations is the probable relationship between the column of the crinoid and the central or sur-anal plate of the echinoid; how may one of these structures reasonably be derived from the other? and how may widely different types of columns such as those of *Edriocrinus*, *Phrynocrinus*, *Platycrinus*, *Metacrinus*, *Holopus*, *Bathycrinus*, *Calamocrinus*, etc., be logically reduced to a primitive common ancestor?

First of all there is one feature which may, perhaps, require a word of explanation. I have homologized the column of the crinoid with the sur-anal plate of the urchins, and for this I have been criticized by my friend, Dr. Th. Mortensen, of Copenhagen, on the ground that the so-called "Palæoechinoidea," the oldest known echinoids, lack the sur-anal plate. I was aware of this fact at the time I wrote the paper, but it did not appear to me to have any weight whatever, for in the structure of the test the "Palæoechinoidea" are in certain ways far more specialized than any recent species, and, as specialization is usually accompanied to a greater or lesser degree with the suppression of more or less fundamental primitive structures, I assumed that, although the sur-anal plate was usually retained in a more or less reduced form by all recent types, there was no reason for supposing that, were the recent genera to attain multicolumnar ambulacral and

^a Vol. 43, p. 682, November, 1909.

interambulacral areas instead of their more primitive bicolumnar areas, such an advance would not be accompanied by the dwindling and disappearance of the sur-anal. Because the clavicles are small or entirely absent in the mostly extinct Ratitæ, while in all cases well-developed in the mainly recent Carinatae we can not pronounce them unessential features of vertebrate morphology.

The common ancestor of the Heteroradiata Echinoderms was an unattached organism with a central dorsal plate surrounded by two, or possibly three, alternating circlets of plates. The Echinoidea, which have remained unattached, retain to-day the original arrangement in a slightly modified form; the Crinoidea, however, instead of maintaining a position in which the dorsal side is up and the mouth down, became inverted, so that the mouth and peristome is up and the dorsal side down. This brought the central plate into permanent contact with the sea floor, and, the central plate being a physiologically inert skeletal structure, a calcareous element whose shape and thickness are in no way confined within narrow limits by physiological or mechanical limitations, it became attached to the sea floor by a simple increase in thickness. The facility with which organisms with calcareous skeletons become attached, even though belonging to normally free groups, is graphically illustrated by *Etheria*, *Mülleria*, *Spondylus*, *Ostrea*, *Balanus*, and various other genera, the developmental stages of which show that the sessile mode of existence is of comparatively late phylogenetic inception.

MacBride has observed that the larvæ of *Asterina gibbosa* in the early stages of development attach themselves for a short time by the præoral lobe, and from this circumstance it has been argued that the ancestors of all echinoderms were attached. I quite fail to see the force of this reasoning; the larva of *Asterina* at the time of its short attachment is at a very young stage. The larvæ of echinoderms are creatures of a high state of specialization, a specialization along entirely different lines from that of the adults, fitting them for a radically different mode of existence; and it seems to me that the only logical course is to treat the larvæ and the adults as different classes of animals, modified for an entirely different environment, each highly specialized in its own way. Thus I consider that the action of the *Asterina* larva is of interest only in comparison with other echinoderm larvæ of a corresponding stage of development, and is and can be of not the slightest significance as regards the adult life either of *Asterina* or of any other echinoderm; in other words, that, in general, echinoderm larvæ are only interesting or significant as echinoderm larvæ, and not as elucidating the phylogenetic path which has been traversed by the adults. For instance, the larvæ of *Echinus* are highly specialized pelagic plutei, those of *Antedon* almost annelidan in character and with a greatly reduced duration of free

existence; this would seem to indicate a great phylogenetic difference; but the species of *Antedon* are of exceedingly limited distribution; those of *Tropiometra* have a very wide distribution, necessitating a prolonged free-swimming stage; are we justified in saying that the larvæ of *Tropiometra* may not turn out to be plutei or something like them? Echinoderm larvæ I consider to be in exactly the same category as arthropod larvæ, useful in some ways, highly deceptive in others.

Attached by the central plate, our theoretical ancestral crinoid has two possible courses to follow: (1) It may increase the area of its attached base, or (2) it may increase its thickness, thus forming a column. In recent forms the first possibility is realized in the young of *Holopus* as figured by Mr. Agassiz; the base has spread out enormously, so that the animal presents a striking similarity to certain low species of *Balanus*, the ten arms being countersunk, as it were, in a depression at the apex of a broad low truncated cone. The second possibility is exemplified among recent forms by the adult *Holopus*; the base, instead of further spreading out, gradually becomes elongated, so that the animal is raised up for a considerable distance on a thick stalk. I can see no other explanation of the origin of the base and the stalk in *Holopus*.

Now, a stalk-like that of *Holopus* is limited in its availability for elongation; if it should grow to more than three or four times as long as the minimum diameter, it would rapidly become exceedingly brittle and liable to fracture by the contact of the animal with other organisms, or even from the effects of wave motion. There are, again, two possible lines of development: (1) The animal may break off and thus secondarily become free, or (2) the column may break in so far as the calcareous substance is concerned, yet remain in continuity through the organic base, thus developing an articulation which would admit of a very considerable additional elongation, at least double that of the original column. No recent crinoids are known in which the first line of development obtains; but it is seen in the fossil *Edriocrinus*. No crinoids are known in which the stem is composed simply of two columnars, as would be the case in the first stage of the second line of development. But suppose we carry this line further; we have a crinoid attached by a stalk in which an articulation has developed in the middle; such an articulation would of necessity develop a fulcral ridge running across the joint faces and embracing the central canal, admitting of motion in a single plane, perpendicular to that in which the original blow causing the fracture was received. Stem growth would continue; but, as new deposition occurs only just under the calyx, only the outer columnar would increase in length. Soon the outer columnar would become so long as to become brittle, as did the original stem, and fracture

would again occur midway between the first articulation and the calyx. Now, this fracture would almost certainly differ from the original fracture in being formed at right angles to it; for any force exerted in the same plane as that which caused the original fracture would be taken up by the articulation which has formed; but, owing to the definite direction of, and close union along, the fulcral ridge, any force coming parallel to the fulcral ridge, that is, at right angles to the original force, would meet with resistance, as for a force exerted in this direction the original articulation would be practically nonexistent, and a second fracture would occur in the weakest spot, namely, halfway between the original articulation and the calyx, developing into a second articulation in which the fulcral ridge would run at right angles to the direction taken by that of the first. A still further increase in stem length would mean a progressive increase in the number of articulations, each of which would, in the direction taken by its fulcral ridge, alternate with those on either side; and thus would eventually be formed the primitive polycolumnar crinoid stem, a stem exactly comparable to the stem of *Rhizocrinus*, *Bathycrinus*, or the young of *Antedon*.

Now, there is a definite limit to the possibilities of further growth in a stem composed of long columnars fastened end to end by alternating articulations consisting of two ligament masses separated by a fulcral ridge; if the animal remains small with a small light crown, such a stem may attain a length of one hundred or more columnars safely; but if the crown should become of large size and heavy, a stem of this type would not be able to support it; the growing tendency to "buckle" would therefore limit the available length of a stem of this nature.

There are four possible ways of escape from such a calamity: (1) The stem may be discarded; (2) the individual columnars may become greatly shortened, the motion lost through the great diminution of the original beveling at the articulations being compensated by the greatly increased number of articulations in a given section of stem, and the columnars may become enlarged along these lines; (3) they may alter the direction of their fulcral ridges, so that, instead of each being at right angles to those preceding and succeeding, they may each lie at only a slight angle to the preceding (all diverging toward the same side), thus mutually bracing each other and attaining a collective rigidity like a pile of narrow boards built up spirally; or (4) the original fulcral ridge may disintegrate, each half breaking up longitudinally and spreading out fanlike, the two fanlike figures eventually uniting to form an articular surface composed of numerous uniform radiating lines.

The Comatulida fulfill the conditions of the first possibility; before the animal is large enough to cause any danger of "buckling" the stem is discarded at the articulation between the topmost columnar

(which becomes the centro-dorsal) and the next following. *Phrynocrinus* is the only known instance of the second case. The curious fossil *Platycrinus* typifies the third. Among the recent forms *Ilyocrinus*, *Ptilocrinus*, *Calamocrinus*, and the genera of Pentacrinitidæ are examples of the fourth. The change from the type of stem characteristic of the young of *Antedon* to that characteristic of *Phrynocrinus* may be traced step by step in the genus *Rhizocrinus*, beginning with *R. lofotensis* and ending with the gigantic *R. weberi*, very near in stem structure, though vastly inferior in size of crown, to *Phrynocrinus nudus*. The transition from the primitive type of stem to the curiously twisted column of *Platycrinus* may be easily followed in a good series of the young of any species of that genus, or even in single specimens in which the young stem is preserved. I have observed the change from the *Antedon*-like young stem to the radially arranged adult stem in *Isocrinus*, and have noticed that in the largest species of *Bathycrinus* the fulcral ridges of the articulations broaden out on each side of the central canal, becoming more or less wedge shaped or triangular, and breaking up into radiating lines, the articulations thus approaching the uniformly radiated type found in *Calamocrinus* and *Ptilocrinus* so closely as to leave no possible doubt as to their mode of origin.

It might be urged that the articular faces of the columnars of the Pentacrinitidæ, with their petaloid markings, could not be placed in the same class with articulations like those of *Calamocrinus*, where the joint faces are uniformly marked with radiating lines; but in the Pentacrinitidæ it is merely a case of the columnars, primarily with articular faces bearing regular radiating lines, being moulded or cast into petaloid sectors by the under surface of the basals against which they are formed, these basals being in a curiously reduced condition, midway between the normal type of basal, as seen in *Calamocrinus* or *Ptilocrinus*, and the atrophied and metamorphosed condition seen in *Antedon*.^a

I can see no other way of deriving the stems of the recent and most fossil crinoids than by supposing them to be the homologue of the central plate of the crinoid-echinoid ancestor which has gradually become thickened and elongated and developed transverse alternating fractures which have metamorphosed into definite articulations. The fact that, when viewed by polarized light, the axis of crystallization is seen to follow the axis of the stem while in the basals and radials it passes at right angles to the plane of their surfaces, and therefore also in the same direction toward the center of the calyx would seem to suggest that the sum of the columnars was

^a Since the above was put in type there has come to light a remarkable genus, *Proisocrinus*, in which the lower part of the stem resembles that of *Calamocrinus*, but the upper part of *Isocrinus* showing that this transition, foretold by deduction, actually occurs.

equivalent to a single calyx plate. Of course many animals, as for instance *Boltenia*, attach by a small portion of their external covering which becomes pulled out into a more or less slender stalk of greater or lesser length; this elongation of the external covering would carry with it any calcareous structures which happened to be included in it. Numerous cases of such elongation of the external body wall are found in echinoderms, for instance in *Caulaster*, or in the Elaspoda.

Dr. F. A. Bather believes that the stems of crinoids originated thus, from the prolongation of the posterior part of the body of a more or less irregularly plated hypothetical ancestor, the plates carried out into the primitive stem becoming later regularly arranged. I can see no reason for assuming that the stems of crinoids were derived from the stems of blastoids by any such process; they probably originated independently in each. I consider the type of crinoid stem composed of pentameres to represent a different sort of structure from that in the recent crinoids; whereas the latter is the equivalent of the central plate alone, the former is derived from a somewhat more extensive primitive base, not confined to the central plate, but involving the first circlet of five plates. A stem composed of pentameres, then, is made up of a series of repetitions of the lowest circlet of plates in the crinoid calyx, and the original central plate would be retained within the first of these extra circlets laid down, that is, instead of remaining at the calyx, the central plate has become fastened to the sea floor forming, as it were, a plug in the end of a long tube composed of morphological repetitions of the circlet of plates surrounding it. These pentameres, as described by Doctor Bather, gradually came into closer and closer contact so that eventually columnars were formed resembling those of *Calamocrinus*, though morphologically entirely different. So far as I know, sections of pentameres and of columnars derived through pentameres have not been examined to determine the axis of crystallization. It seems probable that in these cases the axis of crystallization will be found to run inward direct from the periphery of the stem toward the center instead of parallel to the main axis of the stem as in the other type.

The stalk of *Holopus* has been cited as an example of attachment by the central plate, and of an elongation of that attachment; but in reality the case is not quite so simple; in fact, *Holopus* is something of a combination of these two types of stem formation, for, in addition to the expanded and elongated base, the basals and the radials have become pulled downward so that instead of forming a cup they form a tube continuous with the expanded base and join with the expanded base in producing the stalk. If the stalk of *Holopus* should become greatly elongated it is a question whether a *Rhizocrinus*-like stem would be formed, or whether the basals would elongate and, by progressively developing a series of sutures, result in a stem formed of pentameres.

SUMMARY OF THE SHELLS OF THE GENUS *CONUS* FROM THE PACIFIC COAST OF AMERICA IN THE U. S. NATIONAL MUSEUM.

By WILLIAM HEALEY DALL,

Curator, Division of Mollusks, U. S. National Museum.

The researches of Bergh have shown that the genus *Conus* is a very natural one, and that, while the anatomical characters show, like the shells, considerable variation, there is no evidence as yet of any distinctly characterized groups, anatomically speaking, which would enable us to divide the genus in harmony with the conchological characters or on the anatomy alone. The color pattern, the general form, and sculpture of the shell still remain the most constant, as they certainly are the most convenient, characters for separating the genus into sections.

A study of the coloration of the species leads one to believe the range of variation among the species to be greater than conchologists have usually been ready to admit. On the other hand, the identifications made from imperfect figures are responsible for much confusion among similar but not identical things.

Among cones of several groups, such as the *Proteus* group, the *Nebulosus* group, and the *Brunneus* group, the coloration, on careful study, is seen to consist of a mingling of several distinct elements, each of which has its distinct series of variations. The combinations resulting are therefore quite numerous and, without close study, give very different aspects to the shells, thus obscuring their relations to each other.

In most cases there are nebulous masses of color which contrast with the ground color of the shell and may be paler or darker, are usually disposed in a nebulous manner without any well-defined pattern, and sometimes are concentrated in axial streaks or flames.

There is a tendency for these masses of color to become less conspicuous near the shoulder, at the middle of the whorl, and near the base, giving rise to more or less distinct spiral bands or lighter areas in these areas of the surface. The axial streaks before mentioned are apt to be broken or angulated where they cross these areas, thus giving rise to distinct, spiral, usually lighter, color bands.

These nebulæ are frequently blotched with white or the ground color of the shell, and usually the nebulous color is intensified at the anterior border of the blotch, as if the color glands, while the surface of the white patch was being secreted by the usual process, had ceased functioning temporarily, and begun again, with special intensity when terminating the period of inaction.

The second set of coloration features is produced by fine axial lineation, the lines being usually dark in color. When they intersect at right angles to the spiral banding they form tessellation; when they develop zigzags and in the absence of distinct spiral bands we have the coloration of light tent-like triangles, imposed upon the ground color, as in the *Textile* group of cones.

In the complex of color pattern the last factor comprises spiral lines, often alternating light and dark; or their continuity may be so effectually interrupted that the dark parts are reduced to dots and their relation to the spiral lineation be obscured. There are also pale and dark individuals where the lineation is lost entirely and no nebulæ occur, so that the relation of the individual to the species must be deduced largely from the form and sculpture.

Most cones have, near the canal, more or less spiral sculpture, and in some species like *C. arcuatus* this sculpture may sometimes be confined to the anterior part of the whorl and at other times may invade the whole lateral surface, reaching nearly or even quite to the shoulder. Failure to realize this difference within the species is responsible for some unnecessary names.

The spire may be convex or concave, the fasciole between the shoulder and the suture may be swollen or excavated, smooth or spirally striate. The shoulder may be rounded, carinate or even coronated by a series of nodules. These characters are usually pretty constant and may be relied upon for specific diagnosis.

A recent attempt to revise the West American Cones in the National collection and correct the nomenclature led to the preparation of the following summary, which may be regarded as preliminary material toward a future monograph. Some new forms are added to the fauna and some species confused with others in the past have received distinctive names.

Family CONIDÆ.

Genus CONUS Linnæus.

CONUS FERGUSONI Sowerby, 1875.

Magdalena Bay, Lower California, to Ecuador and the Galapagos Islands.

This white and rather rude species is the largest of the genus on the west coast of America.

CONUS PURPURASCENS Broderip, 1833.

Magdalena Bay, Lower California, to Manta, Peru.

The color variations of this handsome species are dazzling, but the general habit of the shell is quite constant.

CONUS PURPURASCENS, var. **REGALITATIS** Sowerby, 1834.

Cape St. Lucas and southward to Peru, the Galapagos and Clipperton islands.

In this variety the nebulous brown obscures the brighter coloring and the spiral lineation, but the mesial light spiral band is unusually conspicuous.

CONUS PURPURASCENS, var. **REJECTUS** Dall, 1910.

Port Escondido, Gulf of California.

This variety has the nebulous brown very pale and scattered in very small patches over a pale purple or bluish ground color, the whole surface in front of the shoulder being rather closely painted with pale brown, thread-like, articulate, spiral lines. The pale lateral band is still notable. The spire is somewhat lower and the shoulder more angular than usual. The spire is ornamented with a few radiating brown flammules, the sutural fasciole is excavated, smooth, or with only one or two obsolete spiral striae.

CONUS TORNATUS Broderip, 1833.

Cerros Island, Lower California, the Gulf of California, and south to Ecuador.

The original figure in the Conchological Illustrations is quite different from some of the shells to which subsequent iconographers have applied the name. This species is the Pacific analogue of *C. pealii* of the Gulf coast of the United States.

CONUS MAHOGANI Reeve, 1843.

Magdalena Bay, Lower California, to Panama.

The particular mutation to which Reeve gave the name of *mahogani* is an undersized slender shell, in which the brown nebulosity obscures the spiral lineation. The young may be of this type while the adult assumes the coloration of the norm of the species, which has the nebulosity feeble and its conspicuous trait is the articulated spiral lineation on a pale yellowish or bluish ground. The full-grown shell rarely retains the melanitic hue of *mahogani* s. s., but there are all intermediate color gradations. This species is *C. interruptus* Broderip, 1829, and Reeve in the Iconica, but not the *C. interruptus* Mawe (in Wood's Index), 1828.

CONUS COMPTUS Gould, 1851.

Carmen Island, Gulf of California, to Costa Rica.

This species has much the coloration of the preceding with which it has been too hastily united by some indiscriminating writers. It is, however, a much shorter and stouter shell with less nebulation and with a tendency of the spiral coloration to become associated in an anterior and posterior obscure band.

This shell has been generally named *C. puncticulatus* Hwass, 1792, but Hwass distinctly assigns his shell to the West Indies, and there is little doubt but his account and name relate to a combination of *C. papillosus* Kiener, with some Oriental allied form. Our shell is also the *C. perplexus* Sowerby, 1857. It has both smooth and pustulose mutations.

CONUS XIMENES Gray, 1839.

Gulf of California to Sechura Bay, Peru.

This shell is of the same general type of coloration as the preceding, which was also called *C. ximenes* by Sowerby in the Thesaurus, and confounded with *C. mahogani* by him. The true *C. ximenes* is a much larger shell with sparser dotted lineation and pale olive periostracum, with but little brown nebulosity. It seems to be extremely rare.

CONUS CALIFORNICUS Hinds, 1844.

Farallones Islands off San Francisco, California, to Ballenas Lagoon, Lower California.

This very uninteresting little cone is the *C. rarus* Gould, 1851. The young have a faint brown reticulation of the *Textile* type, with a spiral lineation of faint brown continuous lines. The adult is bluish white under a dense brownish periostracum. The largest specimen I have seen is about 35 mm. in length.

CONUS BRUNNEUS Mawe, 1828.

Cape St. Lucas to the Galapagos and Clipperton islands, and on the mainland south to Manta, Ecuador.

This is an irregularly coronated species with a large area of dark brown nebulosity and continuous darker brown spiral lines. A variety of dwarf proportions with exaggerated coronation, deeply striated fasciole on the spire, and coarse prominent pustulation (the latter rarely occurring on the typical *brunneus*) may take the varietal name of *pemphigus*. It has a length of 26 and a maximum width of 17 mm., and was collected at the Tres Marias Islands, west of Mexico. (Cat. No. 37449a U.S.N.M.)

CONUS MILIARIS Hwass, 1792.

Galapagos and Clipperton islands, Ecuador and Peru.

This species is intimately related to *C. brunneus* with which intermediate varieties tend to connect it. It differs most conspicuously in its paler color, absence of the brown nebulosity, tendency of the color to arrange itself in spiral bands, and in the spiral lineation which is articulate and not continuous. In the variety *tiaratus* (Broderip, 1833) the color is more intense and darker, and in still another variety brown nebulosity appears, so that it is only by the broken spiral lineation that the form is assignable to *miliaris* rather than *brunneus*. Our specimens of *C. miliaris* from the Gulf of California are rather poor, but nothing about them seems to justify their specific separation from the Indo-Pacific specimens of which we have a large series.

CONUS GLADIATOR Broderip, 1833.

Gulf of California to the Galapagos Islands.

This is the analogue of the Atlantic *C. mus*. It is very uniform in its dull and unattractive coloration and in spite of Tryon's opinion seems in no way closely related to *C. brunneus*. We do not have it from the mainland south of Panama Bay.

CONUS VITTATUS Hwass, 1792.

Acapulco to Panama.

Specimens from the Tres Marias Islands are more vividly colored than those from the mainland. A question arises as to the relations of this species with *C. coffea* Linnæus, or *fumigatus* Hwass, reported as West Indian, but of which no West Indian specimens have been noted by us.^a The *C. orion* Broderip seems to be a variety in which the spire is not convex; variations in this character can be noted in our series. *C. cumingii* Reeve,^b which is united with this species by Tryon, does not seem to me to be at all nearly related to our species; it is a Philippine shell. *C. henouei* Bernardi, which Tryon unites with *C. orion*, is doubtless a synonym of *C. vittatus*.

CONUS GRADATUS Mawe, 1828.

Gulf of California.

This belongs to a group of cones of which *C. proteus*, *C. floridanus*, and similar species are members, and about which, owing to a wide range of color-pattern, much confusion has existed. The only way to determine the names of the different forms is to go back to the author's original descriptions and figures, those of subsequent authors almost invariably including a certain amount of confusion; and yet when the different forms are segregated there is little difficulty in discriminating between well preserved specimens. In every case here cited the species is believed to be that of the original author, and the attributions of later writers, unless otherwise stated, are ignored.

The norm of this species is a rather slender shell with a moderately exerted sharp spire with slightly concave walls, the coloration being squarish brown maculations on a white ground color. The following forms may be regarded as species or varieties; all that can be said is that for the most part they are easily separated.

CONUS SCALARIS Valenciennes, 1832.

Cerros Island, Lower California, and the Gulf of California.

This is a larger shell with turritid or scalar spire and generally with less brown color and more white ground exposed.

CONUS REGULARIS Sowerby, 1841.

Gulf of California to Panama.

This is a shorter and wider shell with a short conical spire, longitudinal brown nebulous streaks and spiral articulated lines, which

^a The only specimen so named in the collection is one identified by Dr. P. P. Carpenter which was collected at Aden, in the Red Sea.

^b Conch. Iconica, *Conus*, Suppl., fig. 282.

tend to be alternately darker and lighter. I have not found in our large series an exact duplicate in color pattern of Sowerby's original figure in the Conchological Illustrations, but the mass of specimens approach it. As a whole the color effect is darker than in the previously mentioned forms of the group, and there is a notable tendency of the color markings to form groups in the spiral sense.

Another form closely allied to this, which is listed as *C. dispar* Sowerby, in the Thesaurus, though not the original *C. dispar* of the Conchological Illustrations, is characterized by a bluish or livid ground color, which gives a very different aspect to a shell not otherwise separable from *C. regularis*.

This has been collected from Topolobampo, Mexico, to the Gulf of California.

CONUS MONILIFER Broderip, 1833.

Gulf of California. (Magdalena Bay, Lower California, south to Peru.)

This is a smaller and more slender shell than the members of the group just discussed. It has a relatively sharp, elevated, but not scalar spire; and the brown articulations of the spirals tend to be small, distant, and squarish, while the nebulous blotches are smaller and more widely separated.

CONUS INCURVUS Broderip, 1833.

Gulf of California to Ecuador.

This has been confused by Tryon with *recurvus* (Broderip) Kiener, 1839. It is a small shell, with a marked and sharp angle at the shoulder, the sides slightly incurved, the spire short, relatively to others of this group, and the ground color of a livid flesh color. It is easily separated from the others by its general appearance and size, which does not exceed 26 mm. in length in our specimens.

CONUS DISPAR Sowerby, 1833.

Gulf of California.

This is the original *C. dispar* of the Conchological Illustrations. It has the shortest and most disproportionate spire in the group. It is small, narrow, straight-sided, smooth, with a low pointed spire (about one-seventh the entire length) and a few sharp sulci near the canal. The coloration in all our specimens is white or pale, a few light-brown flammules on the spire and nebulous patches on the sides, the spiral painting being mainly of small, distant, sparse, squarish dots with an obscure indication of two paler non-nebulous bands on the sides of the shell.

Though belonging to the *Proteus* group, this seems, as far as our specimens indicate, specifically different from the others.

CONUS EMARGINATUS Reeve, 1843.

Acapulco, Mexico, to Ecuador.

This cone has been well figured on several occasions and is readily identifiable, but great is the confusion to which it has submitted. It

is the *C. arcuatus* of Gray, well figured on pl. 36, fig. 22, of the Zoology of Beechey's Voyage, 1839; but it is not the *arcuatus* of Sowerby in 1829. It is the *C. lorenzianus* of Kiener, Iconography of Conus, pl. 55, fig. 1; and of Reeve, Conchologia Iconica, pl. 27, fig. 152, 1843, but not of supplementary pl. 5, fig. 249, 1849; nor of Dillwyn, 1817. *C. flammeus* Lamarck, *C. zebra* Sowerby (Conch. Ill., fig. 4, 1833) and of Reeve, 1843; and *C. virgatus* Reeve (Conch. Icon., *Conus*, pl. 16, fig. 87, 1843); all of which have been associated with this species, are perfectly distinct from it, though perhaps not from each other. The purple-brown flames which longitudinally ornament this shell are angularly interrupted near the middle of the side, showing a tendency toward a spiral band in that place.

CONUS ARCHON Broderip, 1833.

Mazatlan, Acapulco, west coast Central America.

The shell figured by Sowerby in the Conchological Illustrations is apparently not that subsequently described and figured by Kiener and Reeve. Our shell agrees with Sowerby's original diagnosis and figure, which he pointedly states has "no articulate lines." The granulate shell, *C. granarius* Kiener, is quite distinct from the true *Archon* as well as from *Archon* of Kiener. The latter is probably the same as his *C. sanguineus*. Of the relations of his *C. castaneus* I am doubtful, but see no reason for approximating it to *C. archon*.

Our shell has irregularly distributed chestnut brown flammules on a white ground with a few brown spiral lines near the anterior end, more or less broken, but not "articulated." The surface is smooth; there is no trace of granulation. The spire is rather tumid and not much elevated.

CONUS ARCUATUS Sowerby, 1829.

Cerros Island, Lower California, south to Panama. In mud at a depth of 14 to 50 fathoms.

This is another species in which the original type seems to have been disregarded. In the Conchological Illustrations, soon after the species was described, it was figured by Sowerby in a very characteristic manner. The *arcuatus* of Gray, 1839, already alluded to, is a totally different species, *C. emarginatus* Reeve, which is founded on Gray's figure. Reeve figures a rather dark specimen of the present species in the Conchologia Iconica, *Conus*, pl. 15, fig. 77b. Numerous specimens were dredged by the fisheries steamer *Albatross*. In general the white part of the shell predominates over the brown flammules. The spiral sulcation found at the base frequently extends nearly to the shoulder, while other specimens are almost smooth.

CONUS EDAPHUS Dall, new species.

Off Clarion Island in 31 fathoms, sand; bottom temperature 68°.4 F.; U. S. Bureau of Fisheries steamer *Albatross*.

Shell small, short, stout, solid, with a short acute spire, rounded shoulder, and slightly convex sides; nucleus of two and a half trans-

lucent whitish rounded whorls with a dimple at the apex; of the remaining eight and a half whorls the earlier five have the shoulder irregularly, obscurely, minutely beaded; the slope from the nucleus to the shoulder of the last whorl is slightly concave; the fasciole between the shoulder and the suture behind it is depressed, with two strong spiral sulci running in it, the interspaces rather tumid. The coloration of the shell is peculiar; the pattern recalls *C. tæniatus* and *C. tessellatus*. The ground is a subtranslucent waxen white; between the shoulder and the canal there are about sixteen subequal, rectangularly articulated, spiral bands separated by narrower spaces of the ground color; the articulations are vermilion or orange red and opaque white alternately; on the spire are nearly a dozen radiating orange or vermilion flammules; the interior of the aperture is rosy white, the region about the canal deep rose color; the only sculpture on the sides of the shell consists of about six equidistant channeled sulci, growing wider anteriorly until the canal is reached, and a few smaller striæ on the siphonal fasciole; the aperture is narrow, parallel-sided, with a straight outer lip, the anterior and posterior sinuses moderately deep. Height of shell, 25; of shoulder, 22; maximum diameter of shell, 14; of canal, 3 mm.

Type.—Cat. No. 130385, U.S.N.M.

Although a small shell, it is one of the most lovely of the genus, and its pattern of coloration only paralleled by one or two others in the whole list of species.

CONUS NUX Broderip, 1833.

Ballenas Lagoon, Lower California, and south to Panama and the Galapagos Islands.

This pretty little cone seems sufficiently distinct from the Indo-Pacific species with which it has been consolidated by Tryon. In the large series extending the whole length of its range which is in the National Collection it is somewhat strange that the largest specimen should be that from the most northern locality, Ballenas Lagoon. It is the *C. pusillus* of Gould in 1851, but Lamarck's *C. pusillus* of 1810 was based on a West African shell.

CONUS PRINCEPS Linnaeus, 1758.

Cape St. Lucas to Panama.

This well-known shell is very characteristic with its tufted periostracum. The *C. regius* of authors is an exact synonym, as both diagnoses refer to the variety with broad stripes. *C. lineolatus* Valenciennes, 1832, is the variety in which the stripes are reduced to brown hair lines, and which is the prevailing form from Panama to Peru.

For the variety with the lines entirely absent I propose the name *apogrammatus*. Our specimens of this type are from Panama.

CONUS SANGUINOLENTUS Reeve, 1849.

Guaymas, Mexico, to the coast of Ecuador.

Reeve named two cones after Cuming. The second one appears on the supplementary plate 8 of his monograph, figs. 277*a* and 277*b*, and, of course, the name can not be retained. But on the same plate, fig. 274, he represents a shell differing only from his invalid *C. cumingii* by having the pinkish color of the sides aggregated in a few vertical streaks. This shell of unknown origin he names *C. sanguinolentus*. From the figures it would seem that these two are only color variations of a single species, which will therefore take the name of *sanguinolentus*.

The specimen which best represents this species in the collection (Cat. No. 37399) is of the unicolorate type, and was obtained at Guaymas, Mexico.

CONUS XANTHICUS Dall, new species.

Off Guaymas, Mexico, at station 3011, in 71 fathoms, sand; U. S. Bureau of Fisheries steamer *Albatross*.

Shell biconic, solid, with a low, slightly turritid spire, straight sides and about ten whorls; surface of the whorls on the spire evenly excavated, smooth, or with two or three faint spiral striæ in the channel; periostracum dense, brown, and velvety, except where cleaned off, when the substratum, which is very adherent, may appear polished; suture simple; sides of the shell straight, smooth, with very faint indications of obsolete spiral striation, the striæ rather distant; near the canal there are, as usual, a few spiral cords; outer lip straight, receding to the sinus at each extremity; ground color of the shell white with broad brownish yellow irregular areas so disposed as to indicate three irregular white spiral areas, one near the canal, one at about the middle of the side, and the third somewhat in front of the shoulder. In another specimen the yellow color is generally diffused and only the central band is obscurely indicated; there is no pattern on the spire. Height of shell, 42; of shoulder, 37; maximum diameter of shell, 22.5; of canal, 5 mm.

Two other specimens, probably of the same species, from 7 fathoms, Panama Bay, have the periostracum and coloration of a darker brown. This species appears to be the Pacific analogue of the Antillean *C. flavescens* Gray.

Type.—Cat. No. 111236, U.S.N.M.

CONUS SCARIPHUS Dall, new species.

Off Cocos Island, Gulf of Panama, at station 3368, in 66 fathoms, rocky bottom, one specimen with hermit crab, by the U. S. Bureau of Fisheries steamer *Albatross*.

Shell biconic, attenuated in front, slightly swelling in front of the shoulder, which is sharply carinate; spire low, of about eight whorls without the (lost) nucleus; the summit of the whorls between suture and carina is excavated and smooth; walls of the shell rather thin,

outer lips nearly straight; ground-color yellowish white covered with a thin smooth yellowish periostracum; pattern of fluctuating longitudinal streaks of yellowish brown, which by their zigzag direction and anastomosis leave roughly triangular patches of white of small size all over the shell, except in the middle, where a tendency to the usual paler girdle is manifest; near the canal there are about sixteen paired prominent spiral threads, the intervals between the pairs being more or less channeled; sutural sinus and canal rather deep. Height of shell 41; of shoulder 35; maximum diameter of shell 15; of canal 5 mm.

There are a few small brown spots along the shoulder keel. Though the pattern of coloration is different, the aspect of the shell recalls the Antillean *C. delessertianus*. If the white triangles were bounded by a definite dark line, this shell would approximate the pattern of the *Textile* group. As it is, it is somewhat unique in character.

Type.—Cat. No. 123085, U.S.N.M.

CONUS DALLI Stearns, 1873.

Cape St. Lucas to Panama.

This very handsome cone is the only representative of the typical *Textile* group on the coast of America, so far as known.

CONUS LUCIDUS Mawe, 1826.

Magdalena Bay, Lower California to the Galapagos Islands.

This seems to be a rare and very distinct species.

CONUS SIEBOLDII? Reeve, 1848.

Japan, according to Reeve. Off the Galapagos Islands in 300 fathoms, U. S. Bureau of Fisheries steamer *Albatross*.

The specimen dredged by the *Albatross* had lost its spire and part of the last whorl, but what was left seemed to agree very well with Reeve's figure of *sieboldii*.

CONUS PYRIFORMIS Reeve, 1843.

West coast of Nicaragua and south to Panama and the Galapagos Islands.

This snow-white or pinkish pear-shaped cone can not be confounded with any other. Hinds in 1843 named the young of this species *C. patricius*.

CONUS CONCOLOR Sowerby, 1834.

Acapulco, Stearns collection.

The specimen referred to agrees extremely well with Sowerby's original figure in the Conchological Illustrations, but not with the figure given by Reeve in the Iconica. Sowerby gives no description or locality, but refers in his list to the Proceedings of the Zoological Society of London for 1841. Nothing was published in the Proceedings for that year or any adjacent year in regard to this species. Reeve's shell, which does not agree with Sowerby's, is reported to have come from China. Another figured in the Thesaurus is alleged to be from India.

Our present shell has a dome-shaped spire with a small acute nucleus, irregular suture, the summit of the whorls behind the shoulder being closely and continuously striate. The body color is of a pale reddish brown, intensified at resting stages. The lines of growth on the sides are minutely wavy, crossed by a multitude of almost microscopic striæ, with indications over the surface of more extended but obsolete spiral sulci corresponding more or less closely to fine dark-brown spiral hair lines, and about nine spiral threads with wider interspaces near the canal. The shell is about 50 mm. in length and 25 in maximum diameter.

Whether this specimen is really Oriental and wrongly labeled from Acapulco, or whether it represents Sowerby's original and a distinct species from the Oriental shell I have no present means of deciding.

It will be noted that the geographical distribution given for the species of the preceding list, except when put in parentheses, is based on specimens actually in the collection, and not on the literature. There are several species referred to the Pacific coast in the literature, which are not represented in the list, because we have no autoptical information to that effect.

There are some species which have been associated with the Pacific coast fauna, but are not definitely admitted to our list. Notes on these follow.

Specimens of *Conus proteus* from Panama are in the collection. They doubtless were purchased and originated on the Atlantic side.

A fresh shell of *C. flavidus* Lamarck, was sent by a correspondent as picked up at San Diego, California. It is without doubt exotic.

Conus concinnus Broderip, not Sowerby, renamed by Crosse *C. concinnulus*, is a species of *Meta*, belonging to the Columbelloidæ, and a common Gulf shell.

Conus cinctus Valenciennes, 1832, not of Swainson, 1823, may be the same as *emarginatus* Reeve.

Conus tiaratus Broderip, is regarded by some authors as identical with *C. minimus* Linnæus, which is improbable.

Conus luzonicus Valenciennes, has been reported from the Galapagos Islands, but its real habitat seems to be the Philippines.

Conus diadema Sowerby, 1834, is a variety of *C. brunneus* Mawe.

Conus reticulatus Sowerby, 1833, from Magdalena Bay, is identical with *C. lucidus* Mawe, 1828.

Conus cælebs Hinds, may be the young of *C. fergusonii* Sowerby.

Conus trochulus Reeve, reported from California, is really from the Cape Verde Islands.

Conus perplexus Sowerby, in the Thesaurus, 1857, is identical with *C. comptus* Gould in 1851.

Conus largillierti Kiener, reported from Mexico, is from Yucatan, not the west coast of Mexico, and may prove identical with one of the varieties of *C. proteus*.

Conus hieroglyphus Duclos, is Indo-Pacific.

Conus arenatus and *abbreviatus* are exotic species.

Conus catenatus Sowerby, 1878, from Panama appears to be a variety of *C. interruptus* Broderip.

Conus inconstans E. A. Smith, 1877, from Panama, seems identical with *C. miliaris* Hwass.

Conus prytanis Sowerby, 1882, from the Galapagos, is a variety of *C. brunneus* Mawe.

Conus exquisitus Sowerby, 1887, stated to be from California, is certainly not from California, nor has anything like it been reported from the Gulf of California.

DESCRIPTIONS OF SOME NEW SPECIES AND GENERA OF LEPIDOPTERA FROM MEXICO.

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Among the undescribed forms of Lepidoptera that have accumulated in the collections of the U. S. National Museum, the following have been received from the Republic of Mexico, and are accordingly characterized in one paper.

Family SYNTOMIDÆ.

Genus PSEUDOSPHEX Hübner.

PSEUDOSPHEX MELANOGEN, new variety.

As in *Pseudosphex polistes* Hübner, but the abdomen black. Head black, the face and occiput yellow; antennæ blackish brown; thorax black, the tegulæ bordered before and behind with yellow, the patagia yellow in the center and on both margins; a yellow mark on the disk behind. Abdomen black above, the segments with distinct posterior yellow borders. Wings hyaline, the fore wing yellowish in the cell with a broad smoky brown band beyond the end of the cell to the apex.

Santa Rosa, State of Vera Cruz, Mexico, August, 1906 (W. Schaus).

Type.—Cat. No. 12936, U.S.N.M.

Another specimen from the same locality has a typical brown abdomen, while a third has the black partly replaced by brown, showing the form to be a variety of *Pseudosphex polistes*.

Genus SPHECOSOMA Butler.

SPHECOSOMA NIGRIFER, new variety.

As in *Sphecosoma angustatum* Möschler (= *gracilis* Klages), but the abdomen black with broad apical segmental yellowish bands. The antennæ are black on the shaft and the legs are without any red tint.

Santa Rosa, State of Vera Cruz, Mexico, August, 1906 (W. Schaus).

Type.—Cat. No. 12937, U.S.N.M.

Ten examples are before me from Santa Rosa, and another from Ecuador. I consider the form to be a variety of *Sphecosoma angustatum*.

Genus EPISCEPSIS Butler.

EPISCEPSIS DODABA, new species.

Head and thorax blackish brown, two crimson spots on the back of the head; tegulæ with small crimson spot laterally; fore coxæ crimson. Fore wing uniformly brown-black, slightly bronzy, the veins concolorous. Hind wing black, semihyaline whitish in the cell and below. Abdomen shining blue above, black at the base, the three basal segments white-marked beneath in the male, entirely black beneath in the female. Expanse, 32 to 34 mm.

Santa Rosa, State of Vera Cruz, Mexico, August, 1906 (W. Schaus); Orizaba, Mexico, September, 1906 (R. Müller).

Type.—Cat. No. 12938, U.S.N.M.

Fifty-six examples are before me, including also the localities Cordoba, Jalapa, and Coatepec, Mexico, and Aroa and Merida, Venezuela. The species differs from *Episcepsis inornata* Walker in the presence of a small crimson spot on the tegula. This spot varies in size, and it is possible that the forms intergrade.

EPISCEPSIS FRANCES, new species.

Black-brown, the occiput with two crimson spots; a crimson mark on the pleura below the tegulæ; fore coxæ crimson. Fore wing uniform brown-black, the veins concolorous; hind wing semihyaline in and below cell. Abdomen bright blue above, with black hair at the base, black below, the three basal segments white-marked. Expanse, 27 mm.

Santa Rosa, State of Vera Cruz, Mexico, August, 1906 (W. Schaus).

Type.—Cat. No. 12939, U.S.N.M.

Four males, all from Santa Rosa. On the hind wings beneath there is only a slight semihyaline area below the cell.

Genus TRICHODESMA Hampson.

TRICHODESMA OCEOLA, new species.

Head and thorax brown-black, a diffuse yellow line running along the inner edge of the patagia across the tegula to the base of antenna. Abdomen bluish-black above, gray-black below. Fore wing brown-black, the veins toward the base lined in yellowish, an oblique ocher yellow band from costa beyond middle to inner angle. Hind wing bluish-black, grayish on the margin beneath. Expanse, 38 mm.

Orizaba, Mexico, May, 1908 (R. Müller).

Type.—Cat. No. 12940, U.S.N.M.

Three other specimens from Cordoba, Mexico (W. Schaus, F. Knab), and one from Aroa, Venezuela. The species has the appearance of *Trichodesma ursula* Stoll, but the abdomen is black below. Moreover, the rough scales on the hind wing of the male beneath are confined to a narrow marginal band in *oceola* instead of extending over most of the wing as in *ursula*.

Genus DELPHYRE Walker.

DELPHYRE MONOTONA, new species.

Front gray-brown, vertex of head, anterior edge of tegulæ, base of palpi, fore coxæ, and venter of abdomen except last segment, ocher yellow with slight orange tint; otherwise gray-brown. Fore wing with the veins slightly relieved, a whitish shade beneath the cell and a faint transverse band from outer third of costa to above anal angle, the markings distinct and white beneath and cut by the veins. Hind wing with the cell and beneath whitish semihyaline, the margin broadly and the veins black. Expanse, 37 mm.

Santa Rosa, State of Vera Cruz, Mexico, August, 1906 (W. Schaus).

Type.—Cat. No. 12941, U.S.N.M.

Nine specimens, all from Santa Rosa. The species resembles *Delphyre flaviceps* Druce from Venezuela, but the markings are much less distinct and the dark border of the hind wings narrower.

Genus EUCEREON Hübner.

EUCEREON ROSADORA, new species.

Head and thorax dark brown, occiput orange, neck crimson; abdomen crimson above except the basal segment, pinkish ocherous below. Legs brown, the tarsi ringed with yellowish white at their bases. Fore wing lilacine brown, the veins finely brownish ocher; a rounded darker mark in the cell and one on the cross vein; a subbasal faint yellowish line; an outer more distinct line, excurved beyond the cell, irregularly crenulate; a submarginal line which reaches the margin at the tornus, crenulate and produced along all the veins to the margin. Hind wing grayish black. Beneath grayish black, the fore wing with a pale mark in and beyond cell and the submarginal line irregularly repeated. Expanse, 27 mm.

Santa Rosa, State of Vera Cruz, Mexico, August, 1906 (W. Schaus).

Type.—Cat. No. 12942, U.S.N.M.

One hundred and seventy-five specimens from Santa Rosa and two from Cuernavaca, Mexico.

The species is allied to *Eucereon rosa* Walker, but smaller, darker, and with the markings less distinct.

EUCEREON BALERIS, new species.

Head and thorax blackish brown, a little pale crimson in the neck. Abdomen crimson above, a large triangular basal patch, the last segment, a row of dorsal dots and a lateral band black; venter salmon pink except the last segment. Legs brown with pinkish rings at the joints, the femora pinkish beneath and above. Fore wing dark brown with numerous irregular yellowish brown markings; four blackish spots along the costal edge; a round orbicular spot in the cell, divided by a pale streak; a large spot at the end of the cell, divided by the veins; a large spot at the base of vein 3; the other spots of the usual transverse bands are narrow, elongate, and separated by the paler veins and by cusp-shaped and lenticular yellowish markings, of which the most conspicuous is a zigzag subterminal line cutting off a series of elongate marginal dots between the veins. Hind wing whitish semihyaline in the disk, the veins, apex, and anal angle broadly brown-black. Expanse, 41 mm.

Santa Rosa, State of Vera Cruz, Mexico, August, 1906 (W. Schaus).

Type.—Cat. No. 12943, U.S.N.M.

Fifteen specimens from Santa Rosa. The species is nearest to *Eucereon latifascia* Walker, which also occurs at Santa Rosa, but the dark markings are enlarged so as to almost solidly fill the wing with only linear pale spaces between them.

EUCEREON ERYTHROLEPSIS, new species.

Head and thorax brownish gray, vertex and tegulæ with black dashes, patagia lined with black; abdomen crimson dorsally, a triangular patch at the base, the terminal segment and lateral line gray-black; venter centrally on head, thorax and abdomen pale salmon pink, except the last two abdominal segments. Fore wing pale brown-gray, the veins lined with darker gray; a series of narrow elongate black marks between the veins; four marks on the costa, the basal one narrow and oblique; four marks in the upper part of the cell and a dash in the lower part; five narrow dashes along submedian fold; five dashes on vein 1; a long thick dash above inner margin, narrowing to the base, and one before tornus; above vein 2 are three rows of dashes, continued between the veins to the costa, the terminal and subterminal rows being somewhat rounded and faintly ringed by the pale ground color. Hind wing semihyaline on the disk, the veins, apex, and anal angle black. Expanse, 36 mm.

Cordoba, Mexico, May, 1906 (W. Schaus).

Type.—Cat. No. 12944, U.S.N.M.

Other specimens from Jalapa (Schaus collection) and Orizaba (F. Knab), five in all. Allied to *Eucereon pilati* Walker, but paler, the

lining of the veins grayer, all the marks narrower, more linear, especially noticeable in the spot at base of vein 3, while the abdomen has no dorsal dots.

EUCEREON XANTHODORA, new variety.

A variety of *Eucereon rosadora*, described above, in which the abdomen and other parts which in *rosadora* are crimson are here orange yellow. Of the long series before me of *rosadora*, only nine belong to this variety. They are all alike, and there are no specimens intermediate in color.

Santa Rosa, State of Vera Cruz, Mexico, August, 1906 (W. Schaus).

Type.—Cat. No. 12945, U.S.N.M.

The form comes close to *Eucereon lutetia* Druce, but in that three basal segments of the abdomen are dark above instead of one, while the whole ventral surface is black instead of pale yellow.

Family LITHOSIIDÆ.

Genus GNAMPTONYCHIA Hampson.

GNAMPTONYCHIA ORSOLA, new species.

Head, collar, whole ventral surface and anal tuft of male ocher yellow; thorax and fore wings dark slate gray; abdomen and hind wings dull black; antennæ, tongue, and most of the tibiæ and tarsi black. Expanse, 38 mm.

Mexico City, Mexico, May, 1909 (R. Müller).

Type.—Cat. No. 12946, U.S.N.M.

Two others from Mexico City (A. Dugès) and one from Popocatepetl Park, June, 1906 (W. Schaus). The species resembles *Inopsis catozantha* Felder except for the yellow anal tuft, but it does not belong to that genus.

Genus CLEMENSIA Packard.

CLEMENSIA LEISOVA, new species.

Fore wing soiled white with irregular black and brown markings. The markings form principally a transverse, broken, inner band, discal mark and spottings above the inner margin; a narrow irregular brown mesial line. Hind wing with the apex squarely pointed, whitish, dusky shaded outwardly, the cell clothed with dense appressed pale yellow scales, a fuscous spot near the middle of outer margin. On the fore wings beneath a long tuft of brown hair, followed by a patch of brown mealy scales. Expanse, 22 mm.

Jalapa, Mexico (Schaus collection).

Type.—Cat. No. 12947, U.S.N.M.

One male is before me. The species closely resembles *Clemensia albata* Packard in markings, though the specimens are lighter and more broken than usual in that species, but the secondary sexual characters of the male differ. The tuft on the fore wing below is larger than in *albata* and darker and is followed by a patch of modified scales, while the hind wing has a patch of modified scales covering the cell above.

CLEMENSIA ALEMBIS, new species.

Fore wing grayish white, densely irrorated with brown; a broad inner black curved band, preceded by a clear whitish space; a rounded black discal spot; a subterminal dentate line of the ground color; terminal space of the ground color, with terminal row of black dots. Hind wing with smooth pale yellow scales over the cell, the costal area pale, the rest of the wing smoky blackish. On the fore wing below is a large tuft of hairs and a patch of modified scales in the area below the median vein, which is expanded at the expense of the cell, the latter being crowded costally; costa folded over at the base with a tuft at the end of the fold. Expanse, 21 mm.

Cordoba, Mexico, January 28, 1908 (F. Knab).

Type.—Cat. No. 12948, U.S.N.M.

Another specimen is before me, collected January 15, and a third taken in the same place, May, 1906 (W. Schaus). This species is distinguished from the others in the group by the heavy black band on fore wing and the great development of the secondary sexual scale characters.

Family ARCTIIDÆ.

Genus HALESIDOTA Hübner.

HALESIDOTA LUA, new species.

Head and thorax straw color, shaded with sordid brownish; abdomen brownish, the tip straw color. Fore wing straw color, with concolorous, brown-ringed spots very faintly indicated, traversing the wing in rows parallel to the outer margin. The lower half of the median space is shaded with brown and there is a brown line along the inner margin and on the fringe. Hind wing broadly smoky brown on the margin with a faint large discal cloud, the markings illy defined from the lighter basal part of the wing. Beneath the shadings are repeated, browner and better defined. Expanse, 38 mm.

One male, Zacualpan, Mexico, July, 1909 (R. Müller).

Type.—Cat. No. 12829, U.S.N.M.

The species falls in Hampson's tables next to *Halesidota sthenia*.^a

^a Cat. Lep. Phal. Brit. Mus., vol. 3, 1901, p. 155.

HALESIDOTA VANGETTA, new species.

Head and collar ochereous brown, the patagia lighter toward the tips, with two black spots on each; abdomen ochereous brown above, lighter beneath. Fore wing rather thickly irrorated with brown; an indistinct clouded brown line from apex to lower end of cell, cut into by crescentic marks of the ground color, which are parts of the usual spots, elsewhere nearly obsolete. A large triangular area on the middle of the inner margin and the base of the wing are less heavily irrorated with brown and appear lighter than the rest. Hind wing suffused with brown below the median vein, a dark brown discal mark and two spots at the apex. Expanse, 47 mm.

One male, Misantla, Mexico, January, 1909 (R. Müller).

Type.—Cat. No. 12830, U.S.N.M.

The species falls next to *Halesidota pulvere*a and *H. coniota* in Hampson's tables.^a

Genus HYPOMOLIS Hampson.**HYPOMOLIS LITHOSIAPHILA, new species.**

Black, the fore wings with a bluish luster; a large orange yellow spot at the base, not attaining costa or inner margin, its outer edge oblique. Hind wing with an elliptical patch on basal half of costa. Beneath the markings repeated. Expanse, 26 mm.

One female, Tehuacan, Mexico, July, 1909 (R. Müller).

Type.—Cat. No. 12831, U.S.N.M.

ZAMOLIS, new genus.

Fore wing with vein 2 toward middle of cell, 3 from before angle, 4 and 5 separated, 6 from upper angle of cell, 7 and 8 stalked, 9 and 10 stalked, no accessory cell, 11 from the cell; hind wing with vein 4 absent, 3 and 5 separate at origin, 6 and 7 stalked, 8 joined to cell for basal third. Palpi short, porrect; tongue small; front with a rounded conical projection. Hind tibiae with four small spurs. The ocelli are large and distinct.

Type of the genus.—*Zamol*is *noctella*, new species.

ZAMOLIS NOCTELLA, new species.

Black, unmarked, the fore wing with a brownish metallic luster, the hind wing with a blue luster, changing to green on the inner margin. Beneath fore wing black, hind wing with greenish luster. Expanse, 26 mm.

One male, Cuernavaca, Mexico, July, 1909 (R. Müller).

Type.—Cat. No. 12832, U.S.N.M.

^a Cat. Lep. Phal. Brit. Mus., vol. 3, 1901, p. 164.

Genus IDALUS Walker.

IDALUS AGRICUS, new species.

Head and thorax white, collar tipped behind with crimson; patagia with an ocher mark, a few ocher and crimson hairs on disk of thorax. Abdomen crimson above, the tip white, all white below. Fore wing pale ocher yellow, the costa white; basal space pale gray, cut into bars by the whitish veins, narrow on costa, a crimson mark on inner margin at base; an upright pale gray band across end of cell, expanded on costa and below vein 2, cut into bars by white veins and edged on both sides by white below vein 2; a crimson mark on vein 1 at anal angle; a round gray spot between veins 5 and 6 outwardly. Hind wing white, a little crimson at the base. Expanse, 28 mm.

One male, Misantla, Mexico, May, 1909 (R. Müller).

Type.—Cat. No. 12949, U.S.N.M.

Allied to *Idalus admirabilis* Cramer and *I. agastus* Dyar (= *pichesensis* Hampson, not Dyar). It differs from the former in the presence of a crimson mark on vein 1 outwardly and from the latter in the shortness of this mark and in the shape of the gray band. In *agastus* this band is strongly cut by the pale veins and is produced outward below nearly to the anal angle, while in *agricus* it is only faintly cut by the veins and is but slightly produced, terminating roundedly between the veins.

Family NOCTUIDÆ.

Genus EUXOA Hübner.

EUXOA CATACLIVIS, new species.

Thorax with black and brown scales intermixed, without lines; abdomen dark. Fore wing blackish gray over the lower half, the costa dark, a light clay-colored shade over the cell; lines nearly obsolete, the inner faintly indicated below the cell, the outer traceable throughout its course, single, dentate, and dotted on the veins; orbicular small, round, black; reniform pale-filled, doubly ringed with black; orbicular much elongate, lanceolate, joining the reniform and running nearly to the base of the wing, with a central black dash; outer part of the cell and beyond black-filled, the veins beyond black-lined, the inner spaces clay colored with central dark dashes; fringe dark with light points at the bases of the veins. Hind wings whitish, shaded with fuscous, especially along the margin. Expanse, 33 mm.

One male, Orizaba, Mexico, September, 1901 (R. Müller).

Type.—Cat. No. 12950, U.S.N.M.

Nearly allied to *Euxoa proclivis* Smith (= *oaxacana* Schaus); distinguished by the light-colored cell and peculiar orbicular.

EUXOA ARABELLA, new species.

Head and thorax purplish gray, the tegulæ with a black band across the middle; patagia with black inner edging; abdomen dark gray, the anal tuft of the male lighter. Fore wing purplish gray, lighter below the cell; costa broadly pale clay color to the end of the cell; space below cell to inner line with a deep black shade; cell filled in with black around the ordinary spots to outer line; a black shade along middle of outer margin; lines faint, single, crenulate, blackish, the inner with a small black spot in place of the claviform; orbicular minute, rounded, pale clay color; reniform large, pale clay color, contrasted, with an inner concentric brown ring; a terminal black line, dentated between the veins; fringe pale clay color, interlined with brown; a brownish shade along the costal edge. Hind wing whitish, without shadings, a fine dusky terminal line. Expanse, 37 mm.

One male, Cuernavaca, State of Morelos, Mexico, August, 1906 (W. Schaus).

Type.—Cat. No. 12953, U.S.N.M.

Allied to *Euxoa albicosta* Smith (= *manethusa* Druce), but distinctly broader-winged, the costal shade broader, less firmly limited and not lined; reniform also much larger. The frontal structure also differs; in *albicosta* the front is roundedly protuberant, irregularly roughened with a transverse line below; in *arabella* the central raised area is crossed by irregular transverse ridges forming a distinct central elliptical area.

Genus *AGROTIS* Ochsenheimer.*AGROTIS INCUMBENS*, new species.

Head ferruginous red; tegulæ black behind, clay colored in front with a white line separating the colors; thorax red-brown; abdomen gray-brown. Fore wing red-brown powdered with ocherous outwardly, the costa broadly clayey yellow, becoming diffused beyond the middle; a large black mark at the base below median vein; a black dash in the upper part of cell before orbicular; inner line faint, blackish, narrow, single, running outward along vein 1, then curving to inner margin almost at the middle; claviform absent; orbicular a large, round, ocherous ring; reniform large, diffused, blackish, partly bordered with ocherous irroration; outer line straight, curved a little toward costa, diffused, composed of ocherous irrorations with a little black shading within; subterminal line composed of two wavy lines of ocherous irroration, inclosing an area of the red ground; fringe red, lighter and more orange tinted than the rest of the wing. Hind wings fuscous shaded, the veins darker; fringe pale clay color. Expanse, 52 mm.

One female, Zacualpan, State of Vera Cruz, Mexico, June, 1909 (R. Müller).

Type.—Cat. No. 12951, U.S.N.M.

Also four females from Cuernavaca, State of Morelos, Mexico, June and July, 1096 (W. Schaus). The species is allied to *Agrotis mizteca* Schaus (= *mysteca* Hampson), but is much larger, the costal shade diffused outwardly, the cell not black filled, and the lines different.

AGROTIS AGIS, new species.

Head and thorax dark brown without markings; abdomen ochereous brown, overlaid with blackish dorsally, dark red-brown on the sides and beneath. Legs dark red-brown, blackish on the tarsi, the fore tibiae and tarsi light ocher-brown in front, fore wing ochereous brown in subbasal space and terminally, violaceous brown in the small basal space and median space; lines violet brown, not strongly contrasted, geminate, the subbasal line bounding the basal space, inner line strongly angled outward in the cell, elsewhere coarsely crenulate; outer line parallel to outer margin in its course except near the costa where it bends in slightly, finely crenulate on the veins; orbicular a large narrow brown ring, open above; reniform very large, outlined in brown, with a blackish cloud in its lower half; claviform obsolete; subterminal line red-brown, crenulate, diffused inwardly, forming a slightly dislocated blotch on the costa; a row of terminal black dots between the veins; fringe concolorous with the terminal space. Hind wing fuscous, the veins darker, the fringe clay colored, touched with brown at the ends of the veins. Expanse, 49 mm.

One female, Zacualpan, State of Vera Cruz, Mexico, September, 1909 (R. Müller).

Type.—Cat. No. 12952, U.S.N.M.

Not closely allied to any Mexican *Agrotis* known to me.

Genus EUOPTOCNEMIS Grote.

EUOPTOCNEMIS APHRONUS, new species.

Head and tegulae ocher gray, thorax gray, without markings. Fore wing rather light gray, powdered with darker, the dark scales predominating in the terminal space; a small black mark close to the base below median vein; inner line of the ground color, relieved by an inward dark shade, slightly irregular, produced outward below vein 1; cell between the inner line and orbicular and again between orbicular and reniform filled in with black; a small oblique black dash on submedian fold below orbicular; orbicular and reniform large, concolorous, outlined in clay color, the orbicular with a small point toward the reniform, its upper inner angle open; outer line of the ground color, limited within by a narrow dark line, without by the powdering of the subterminal space; subterminal line, pale, of

the ground color, a dark shade on the costa within its inception; a black line at base of fringe; fringe narrowly light at the base, dark outwardly. Hind wing gray, the fringe pale, whitish. Expanse, 48 mm.

One female, Cuernavaca, Mexico, June, 1906 (W. Schaus).

Type.—Cat. No. 12954, U.S.N.M.

Genus *LYCOPHOTIA* Hübner.

LYCOPHOTIA ESPÆTIA, new species.

Head and thorax lilacine gray, the tegulæ crossed by a black band. Abdomen yellowish gray, darker shaded on the dorsum, the anal tuft of the male somewhat ochereous. Fore wing lilacine gray, the markings distinct, blackish brown; subbasal line from costa to submedian fold; inner line marked on the costa, somewhat irregular, sharply produced inward on vein 1; claviform and orbicular absent; reniform an upright black bar joined to the median line and forming more or less of a blotch with it; median line marked on costa, oblique to reniform, then straight to inner margin; outer line marked on costa, slender, crenulate, irregularly parallel to outer margin; subterminal line pale, diffused and pulverulent, situated in a dark shading, which obtains to the termen; a row of obscure dark terminal dots; fringe dark. Hind wing whitish, slightly shaded, the veins a little darker and the margin narrowly dark; fringe pale. Expanse, 37 mm.

One male, Las Vegas, State of Vera Cruz, Mexico (Schaus collection).

Type.—Cat. No. 12955, U.S.N.M.

Allied to *Lycophotia lubricans* Guenée, but not particularly allied to the form *beata* Grote, which is found in New Mexico. The present form is large and distinctly marked, and, though allied to *lubricans*, is, I think, a distinct species and not a local race of it.

LYCOPHOTIA PELLUCIDALIS Grote.

This species has not heretofore been reported from Mexico, but seems to be rather widely spread in the country. I have a specimen from Mexico City, May, 1908 (R. Müller); Cuernavaca, State of Morelos, Mexico, July, 1906 (W. Schaus); Las Vegas, State of Vera Cruz, Mexico (Schaus collection), included with *Lycophotia infecta* Ochseneheimer (= *incivis* Guenée) by error, and a fourth specimen from Mr. Müller without exact locality.

Genus *TRICHESTRA* Hampson.

TRICHESTRA STIGMATOSA, new species.

Head and thorax with the long scales intermixed olive green and black, the posterior tuft ocher brown; abdomen blackish, the tip pale reddish. Fore wing olive green (discolored to yellowish in the speci-

men), the subbasal space shaded with blackish; reniform and orbicular joined to form a thick, conspicuous, white, bilobed marking, beyond which black powdering fills in to the faintly indicated outer line; subterminal line white, dentate, visible near costa only, lost below in a black shade; three white spots close to the margin centrally; a black cloud at the anal angle; a terminal broken black line; fringe black and white. Hind wing blackish, the fringe irregularly black and white. Expanse, 25 mm. Beneath the fore wing is blackish with an outer black line; reniform and terminal space whitish. Hind wing irrorated with black, the apex broadly ochereous; discal dot and outer line black.

One male, Zacualpan, State of Vera Cruz, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 12956, U.S.N.M.

Genus *HYSSIA* Guenée.

HYSSIA PRODENIFORMIS Smith.

This species occurs in Mexico, though not hitherto recorded. Hampson treats it under *Polia*, but he had no specimens before him, which accounts for the error and also for the extremely poor figure,^a which not only gives no idea of the insect, but is entirely misleading, not only the markings but the shape of the wing being wrongly represented. I have a specimen from Mexico City, Mexico, September, 1909 (R. Müller).

Genus *POLIA* Ochsenheimer.

POLIA NAIDA, new species.

Head and thorax gray intermixed with black, without markings. Fore wing smooth uniform dark slaty gray; basal dash black, long; lines slender, crenulate, illy defined, approximate toward inner margin, joined by a black mark at claviform; reniform and orbicular slightly paler, rounded, black-ringed, the reniform with a dark red crescentic center; subterminal line pale, illy defined, waved; a black dash on vein 2 at margin; fringe black spotted. Hind wing whitish. Expanse, 25 mm.

Two males, one female, Mexico City, Mexico (R. Müller), one specimen taken in August, 1909.

Type.—Cat. No. 12957, U.S.N.M.

Allied to *Polia seminaria* Schaus, but without the diversified ground color of that species.

POLIA EUCYRIA, new species.

Antennæ of male ciliated; prothorax with divided crest. Fore wing dark brown from the base to the outer line, leaving a sub-

^aCat. Lep. Phal. Brit. Mus., vol. 5, pl. 81, fig. 18.

quadrate pale carneous area on the costa at base; a long slender black dash in submedian interspace; inner line, claviform, and orbicular black, slender, the claviform somewhat relieved by a reddish shade beneath the cell; reniform elliptical, oblique, filled with a thick gray ringlet, finely circled with black, its inner segment of the periphery black, the outer segment white; outer line angled on vein 5, whitish, faintly edged within by black, a reddish shade in the angle next to the reniform; subterminal space carneous gray, terminal space blackish shaded, the subterminal line lost, indicated by slight pale powderings; fringe dark, interlined with pale at the ends of the veins. Hind wing whitish in the male, pale fuscous in the female, fringe fuscous. Expanse, 27 mm.

One male, one female, Cuernavaca, State of Morelos, Mexico, June and August, 1906 (W. Schaus).

Type.—Cat. No. 12978, U.S.N.M.

POLIA PHAULOCYRIA, new species.

Dark gray. Fore wing soft, shining, lilacine gray, the median space darkened by a blackish shading below the cell; at base of costa a large, subquadrate, pale, somewhat carneous patch, resting upon the slender black line on submedian fold; inner line geminate, blackish, wavy, obscure; claviform angular, black; orbicular an elliptical ringlet in the dark gray ground; median shade line broad, running close to the outer line below and just within the reniform; reniform black ringed, filled by a broad gray elliptical area, the outer segment of the periphery nearly white; outer line angled on vein 5, pale, not waved, edged within by a black line, a reddish shading between the angle and reniform; subterminal and terminal spaces of the dark ground color alike, a little darker clouded centrally along the margin; subterminal line indicated by a whitish powdering, unusually near the margin; a black line at base of fringe. Hind wing dark fuscous, the fringe pale. Expanse, 25 mm.

One female, Zacualpan, Mexico, August, 1909 (R. Müller); another female, Cuernavaca, Mexico, June, 1906 (W. Schaus).

Type.—Cat. No. 12979, U.S.N.M.

The coloration is much as in *Polia rodora* Dyar (described below), but the pattern of markings is more as in *Polia eucyria* Dyar, the preceding species.

POLIA JOCOSA Schaus.

This species has been made a synonym of *Polia psittacus* Herrich-Schaeffer, but it is abundantly distinct. The dark color on the disk of fore wing is continuous and not broken up by patches of the ground color, while two curved dashes of the green ground color nearly separate a triangular black patch near anal angle. There is no such marking in *psittacus*.

POLIA RODORA, new species.

Soft lilacine gray, shaded with brown through the center of the wing; basal dash slender, dark, obscure; lines geminate, slender, black, scarcely crenulate, illy defined; claviform outlined by brown above; orbicular concolorous, obsolete; reniform outlined in pale yellowish, the line defining it very fine within, thickest without in the emargination; subterminal line flexuous, pale, running into a lilacine subapical cloud; fringe dark and spotted with blackish. Hind wing whitish toward the base, dark fuscous outwardly, the veins dark; fringe pale. Expanse, 28 mm.

One female, Mexico City, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 12958, U.S.N.M.

The species has the general coloration of *Polia pensilis* Grote. It is smaller, the lines well separated, not united by the claviform as in that species.

POLIA SURGENS, new species.

Fore wing gray, shaded with brown in the median and subterminal spaces; lines geminate, powdery, black, the subbasal from costa to submedian fold, followed by a black cloud on inner margin; inner and outer lines slightly crenulate, approaching each other toward inner margin, the outer crossing a large ovate pale yellowish patch above tornus; a blackish shade in place of the claviform; orbicular and reniform moderate, filled with pale or yellowish brown, ringed in pale; subterminal line slender, white, forming two arcs, then ending abruptly above the mark at tornus, followed outwardly by black in its incision and inwardly below by three black wedge-shaped marks; terminal space gray-shaded; fringe dark, spotted with blackish. Hind wing whitish on the disk in the male, the margin fuscous; veins dark; fringe pale, interlined with fuscous; in the female darker, largely fuscous. Expanse, 30 mm.

One male, two females, Mexico City, Mexico, August, 1909, September, 1909, October, 1908 (R. Müller).

Type.—Cat. No. 12959, U.S.N.M.

Allied to *Polia olivacea* Morrison, but easily distinguished by the form of the subterminal line.

Genus HYDRÆCIODES Hampson.**HYDRÆCIODES ALALA Druce.**

This species was described from Mexico City from one male specimen. I have a female from that locality, taken by Mr. Müller. This species inhabits the high table-land; the form mentioned by Sir George F. Hampson^a as a subspecies, occurring in the low country is, I think, a distinct species, probably the same as the following.

^a Cat. Lep. Phal. Brit. Mus., vol. 5, 1905, p. 256.

HYDRŒCIODES ANASTAGIA, new species.

Antennæ of the male ciliate. Head and thorax brown, the patagia largely yellow and rufous intermixed. Abdomen brown above, more ocherous below. Fore wing yellow, densely irrorate with rufous; subbasal and inner lines of the ground color, edged with rufous; a straight brown line from near base on vein 1 outward to inner line at middle of cell; orbicular and claviform outlined in brown, the median space beyond these marks densely shaded with brown; mesial line brown, angled outward to lower angle of cell; reniform rounded, of the ground color, irrorate with rufous with three small white spots on its lower edge; outer line of the ground, edged with brown, crenulate on the veins; subterminal space light; terminal space darkly shaded, the subterminal line clearly shown by the separation of the colors, but not appearing as a line; veins narrowly dark lined; fringe dark. Hind wing fuscous shaded, the veins darker, the margin tinged with rufous. Expanse, 28 mm.

One male, Orizaba, State of Vera Cruz, Mexico (Schaus collection).

Type.—Cat. No. 12960, U.S.N.M.

HYDRŒCIODES MENDICOSA, new species.

Male antennæ bipectinate with long branches. Pale clayey yellow, the markings rather light brown; subbasal line obsolete; inner line upright, crenulate, single, most strongly indented on vein 1; orbicular of the ground color, scarcely defined; median shade upright, bent outward narrowly centrally to the lower angle of the cell, this bend scarcely noticeable in the male specimen before me, but distinct in the female. Reniform rather more distinctly defined than the orbicular with small yellowish white dots on its edge below and outwardly; outer line with its outer edge obsolete, a series of little bars on the veins forming projections on the inner edge; subterminal space light; terminal space darkly shaded, the limiting line twice inflexed; fringe dark, somewhat checkered. Hind wing pale with dark terminal line. Expanse, 27 to 33 mm.

One male, one female, Mexico City, Mexico (R. Müller), one specimen taken September, 1906.

Type.—Cat. No. 12961, U.S.N.M.

HYDRŒCIODES FELOVA, new species.

Antennæ of male bipectinate with short branches, about as long as the diameter of the shaft or longer. Yellow, densely irrorated with rufous, the outer half of the wing shaded with umber brown; lines brown, single, crenulate on the veins; orbicular and claviform of the ground color, neatly outlined in brown; median shade line distinct, angled on lower edge of median vein; reniform of the ground color with white specks about the margin, especially at the angles; terminal

area darkly shaded, the subterminal line appearing as yellow patches below the apex. Hind wing fuscous. Expanse, 32 mm.

One male, Jalapa, State of Vera Cruz, Mexico (Schaus collection).

Type.—Cat. No. 12962, U.S.N.M.

HYDRŒCIODES DANASTIA, new species.

Antennæ of the male with short pectinations, shorter than the width of the shaft. Fore wing yellow irrorated with rufous, strongly shaded throughout with purplish brown; the ground color appears narrowly basally, in the stigmata and subterminal line; lines as usual, nearly lost in the general shading; median shade line angled on the lower corner of cell; orbicular and reniform with white dots and streaks around their margins; fringe solidly dark. Hind wing fuscous brown, the fringe a little lighter. Expanse, 30 mm.

One male, Jalapa, State of Vera Cruz, Mexico (Schaus collection).

Type.—Cat. No. 12963 U.S.N.M.

HYDRŒCIODES ZINDA, new species.

Antennæ of male serrate and fasciculate. Thorax ochraceous yellow and rufous brown. Fore wing yellow, irrorate with rufous; lines fine, slender, single, crenulate on the veins; mesial shade line strongly angled at end of cell, forming a right angle; claviform and orbicular outlined in dark rufous; reniform round, of the ground color in a dark rufous shade that extends to the costa subapically, with three small white dots on its lower border; terminal space solidly filled in with dark rufous, pointed inward at vein 5; veins dark lined. Hind wing dark fuscous, the margin tinged with rufous. Expanse, 33 mm.

One male, Zacualpan, State of Vera Cruz ^a Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 12964, U.S.N.M.

Genus ERIOPYGA Guenée.

ERIOPYGA PSEUDOSTIGMA, new variety.

As in *Eriopyga rubripuncta* Schaus, but the upper part of the reniform occupied by a round, pure white spot. The markings on the wings are entirely as in *rubripuncta*, and I consider this form as a variety of that species.

One male, Zacualpan, Mexico, September, 1909 (R. Müller).

Type.—Cat. No. 12965, U.S.N.M.

^a The State is not given upon the original label. I presume it to be the Zacualpan in the State of Vera Cruz, although there is another place of the same name in the State of Mexico.

ERIOPYGA SUBLECTA, new species.

Head and thorax dark brown, abdomen blackish, neck and anal tuft ochereous. Fore wing dark red-brown, base and subterminal spaces shaded with blackish; inner line geminate, curved, blackish; orbicular and reniform of the ground color, unrelieved; median shade line blackish, gently curved; outer line geminate, its outer part punctate, excurved at end of cell; terminal space partly blackish shaded, the subterminal line indicated by the separation of colors of terminal and subterminal spaces. Hind wing dark fuscous, fringe paler. Expanse, 27 mm.

One male, Zacualpan, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 12966, U.S.N.M.

Allied to *Eriopyga mesostrigata* Hampson, but smaller, redder, and without the light color and streaks in the costal part of median space.

ERIOPYGA PANTOSTIGMA, new species.

Antennæ of male ciliate, the abdomen normal, the fore wing with long, very sparse curved hairs on the under side of the cell. Head and thorax dark brown, mixed with blackish; abdomen blackish, the tips of the segments pale. Fore wing light brown, tinged with rufous somewhat irregularly; a black shading in basal space below cell; lines geminate, blackish, very indistinct, the outer segment of the outer line punctate, the line excurved over the cell; median shade line nearly erect, a little curved in the cell; orbicular and reniform filled in with black, not outlined, distinct, conspicuous; subterminal line black, waved, arising in a black costal cloud, followed by a narrow space of the ground color, beyond which the terminal space is shaded with black to the margin. Hind wing fuscous, the fringe lighter and rufous tinted. Expanse, 28 mm.

One male, Zacualpan, Mexico, July, 1909 (R. Müller).

Type.—Cat. No. 12967, U.S.N.M.

ERIOPYGA STRIGIFACTA, new species.

With the structure of the preceding. Thorax dark brown, intermixed with light scales, base and tip of tegulæ ochereous; abdomen dull ochereous. Fore wing gray brown, intermixed irregularly with ochereous and with dark red-brown, the latter especially in subbasal space and before subterminal line; subbasal line indicated by ochereous filling, edged with red brown; inner line geminate, irregularly angled, obscure; costa darkly shaded, the mesial line narrow, red brown; orbicular obsolete, marked only by a black point close to the costal shade; reniform indicated by a black lunule at base of vein 3; outer line very obscure, excurved over cell, with a row of white venular points on its outer edge; veins dark lined; terminal space darkly

shaded, the subterminal line, powdery, broken, yellowish, with a similar yellowish mark between veins 2, 3, and 4. Hind wing yellowish, fuscous tinted outwardly; fringe pale. Expanse, 25 mm.

One male, Zacualpan, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 12968, U.S.N.M.

ERIOPTYGA ANGUSTIMARGO, new species.

With the structure of the preceding. Fore wing ocherous brown, largely shaded with fuscous; ordinary spots obsolete, only the reniform visible, defined as a space of the ground color in a fuscous cloud; inner line curved, blackish, illy defined; outer line crenulate, forming points on the veins; subterminal line dark, distinct, submaculate; fringe dark with light points at the base. Hind wing fuscous shaded especially outwardly; a discal clouded mark. Expanse, 23 mm.

Two males, Mexico City, Mexico, September, 1909, October, 1908 (R. Müller).

Type.—Cat. No. 12969, U.S.N.M.

ERIOPTYGA RHIMLA, new species.

Fore wing yellowish brown in ground color, but heavily darkened by shadings; median and terminal spaces filled with blackish shading; inner line blackish, crenulate; claviform rounded, outlined in black; orbicular of the ground color with a dark central dot; reniform obscured by black shading except its oblique outer border, which is white; outer line produced into a point at vein 5, elsewhere straight, black, edged with the ground color, inclosing a light space between the point and edge of reniform; subterminal space with irregular dark reddish shadings; a black terminal line; fringe dark, with light points at the base. Hind wing shaded with blackish, the fringe pale. Expanse, 28 mm.

One female, Mexico City, Mexico, September, 1909 (R. Müller).

Type.—Cat. No. 12970, U.S.N.M.

Apparently allied to *Eriopyga contrahens* Walker.

ERIOPTYGA CONDENSEA, new species.

Male antennæ very shortly pectinate, the branches not longer than the width of the shaft. Brownish clay color; lines gray brown; subbasal line *geminata*; inner line *geminata*, pointed on the subcosta, twice roundedly outcurved below; median shade line brown, distinct, angled at the lower end of the reniform, which it touches; orbicular a point; reniform solidly black, constricted into two lunules, stained with red at the constriction; outer line pale, of the ground color, even, followed at some distance by a row of pale and dark dots; subterminal and terminal spaces dark brown shaded, cut by the light subterminal line, which has a row of black dots within; fringe

dark brown with a wavy pale line. Hind wing fuscous, lighter between the veins, the fringe rufous tinted. Expanse, 33 mm.

One male, Zacualpan, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 12971, U.S.N.M.

ERIOPYGA INFELIX, new species.

Male antennæ shortly bipectinate. Ocherous brown, more or less darkly shaded; subbasal line invisible; inner line single, strongly crenulate, the flexures pointed on lower half of wing; orbicular a pale ringlet; median shade line indistinct; reniform outlined in pale, clouded with black in its lower half; outer line crenulate, slightly curved at costa, outwardly dotted on the veins; subterminal line pale, powdery, preceded by faint indications of dark dashes; terminal space dark; a light line at base of fringe. Hind wing pale, the veins and outer margin shaded with fuscous. Expanse, 28 mm.

Two males, Mexico City, Mexico, September, 1909 (R. Müller).

Type.—Cat. No. 12972, U.S.N.M.

Allied to *Eriopyga incincta* Morrison, but a slenderer, narrower-winged species, the subterminal line broken and powdery, the terminal space dark.

Genus ERIOPYGODES Hampson.

ERIOPYGODES GRAMMADORA, new species.

Clayey ocherous, the head and tegulæ tinted with brown. Fore wing with the veins broadly lined with blackish, the submedian fold narrowly so; fringe rufous tinted. Hind wing black with pale rufous tinted fringe. Abdomen black above, rufous below, the anal tuft ocherous. Beneath fore wing largely shaded with black; hind wing pale, streaked with black on the median venules. Expanse, 33 mm.

One male, Popocatepetl Park, Mexico, 13,000 feet altitude (W. Schaus).

Type.—Cat. No. 12980, U.S.N.M.

Genus MELIANA Curtis.

MELIANA PERSTRIGATA, new species.

Fore wing light clay color, a little irrorated with black on outer half of costa and apex; a blackish shading beneath median vein, continued to the margin between veins 4 and 5, with a lighter or whitish edging above in the cell, which on veins 3 and 4 cuts the dark shade; a blackish mark between vein 1 and inner margin; fringe shaded with blackish. Hind wing whitish. Expanse, 33 mm.

One female, Mexico City, Mexico, May, 1908 (R. Müller); a second female from the same place, April, 1909, is a little smaller with the

markings paler, but otherwise the same, except that the front is smooth. This second specimen, therefore, would fall in the genus *Cirphis*.

Type.—Cat. No. 12981, U.S.N.M.

The type with the roughened front belongs to the genus *Meliana*, but if this prove to be an abnormality and the species belongs to *Cirphis*, then it will fall near *Cirphis multilinea* Walker.

Genus HOMONCOCNEMIS Hampson.

HOMONCOCNEMIS POLIAFASCIES, new species.

Bluish gray, collar, patagia, and end of thorax touched with rust yellow. Fore wing bluish gray, powdered with black and shaded in lower half of median space and beyond reniform; lines single, dentate on the veins, black, the outer line with white points at the ends of the dentations; claviform small, orbicular elliptical, reniform compressed, but with deep emargination, the spots filled in largely with rust-yellow scales; these scales also edge the inner line within, fill in the lunules of the outer lines below and stain the subterminal line, especially at anal angle; costa with small black marks and four white points before apex; outer line near the margin, whitish, wavy, powdery and clouded, but well contrasted. Hind wing black, the interspaces below the cell whitish, the fringe pale with black central line. Expanse, 35 mm.

One female, Zacualpan, Mexico, September, 1909 (R. Müller).

Type.—Cat. No. 12982, U.S.N.M.

Genus CROPIA Walker.

CROPIA EUROPS, new species.

Head and thorax dark brown, shading to black; abdomen brown, the dorsal tufts darker. Fore wing dark brown, shaded with black and blue basally and broadly along submedian space to outer margin, again in a dash between veins 4 and 5; subbasal line geminate, crenulate, black; inner line similar, both obscure; claviform large, elliptical; orbicular similar; reniform very large, a black line, filled with the brown ground color, a pale brownish lunule near its center; median line oblique from costa to reniform, lost below; outer line black, faintly doubled, wavy, roundedly produced outward at vein 4; an irregular clear brownish ochereous space centrally subterminally, forming an expansion of the subterminal line, which is of this color, powdery, broken, waved, situated near the margin; irregular black saggitate marks are enclosed in the light subterminal area; fringe stained with reddish brown. Hind wing brown, with an outer fine wavy black line; a series of illy defined ochereous spottings subterminally; fringe as on fore wing. Expanse, 55 mm.

One male, Zacualpan, Mexico, August, 1909 (R. Müller); one female, Guadalajara, Mexico (Schaus collection).

Type.—Cat. No. 12983, U.S.N.M.

The antennæ of the male are pectinate, with short lamellate branches.

CROPIA ISIDORA, new species.

Head brownish black; thorax clothed with dense silver-gray-tipped scales. Abdomen with large black dorsal tufts on the third and fourth segments. Fore wing dark lilacine brown, more blackish within the outer line; lines black, distinct; subbasal line single; some silvery whitish scales on inner margin; inner line irregularly wavy, joined by a bar on submedian fold to the outer line, which is outcurved in the middle and incurved on vein 1; an erect black bar from the connecting dash to orbicular; orbicular and reniform brokenly outlined in black, powdered and irregularly centered with white scales; outer line irregularly bluntly dentate, excurved above, incurved below vein 2; terminal space with a black bar on submedian space and on vein 5; subterminal line blackish, waved, faint, and preceded by blackish spots above vein 5; below this point the lines are composed of a series of ocherous white spots, two of which are inclosed by the black bars; between the lower segment of subterminal line and outer line is much white powdering, which indicates a faint outer duplication of the outer line; a black line at base of the concolorous fringe. Hind wing brown with a mesial shaded black line; outer margin powdered with ocherous white, most broadly so at anal angle. Expanse, 42 mm.

One male, Orizaba, Mexico, November, 1909 (R. Müller).

Type.—Cat. No. 12989, U.S.N.M.

The antennæ of the male are simple. The species seems allied to *Cropia hadenoides* Walker, which is not before me.

CROPIA CONSONENS, new name.

In referring to *Cropia hadenoides* Walker, it should be noted that Walker also described *Homoptera hadenoides*,^a which is a *Cropia* as seen by specimens which Mr. Schaus has compared with the type in the Oxford Museum. I therefore propose the above name on account of the preoccupation of the specific name in the genus. Three females are before me. The species seems most nearly allied to *Cropia templada* Schaus, but is larger, without the subapical white shade and with a large brown-black patch in the lower third of the median space between the lines. The specimens are from Venezuela and French Guiana, and are referred to in this paper only for the purpose of straightening out the names in the genus.

^a Cat. Brit. Mus., vol. 15, p. 1799, 1858.

CROPIA RUTHEA, new species.

Antennæ of the male with rather long pectinations, decreasing to serrations at the tip. Fore wing dark brown, lighter, ocherous tinted in basal and subterminal spaces; a white point at base; subbasal line black; an obscure black line above vein 1; inner line black, dislocated on subcosta, angled outward on submedian fold and on vein 1; a black streak from the angle along submedian fold to outer line; claviform illy defined, black; orbicular and reniform narrowly black-ringed, large, the blackish shades within concentrically arranged; three black lines on costa, from the outer of which the outer line starts, angled outward along subcostal vein, angled on vein 5, very faintly doubled and followed by a paler ocherous shade; subterminal line pale ocherous, angled, broken, forming spots below; a black line on vein 5 from outer line to margin, broken by the subterminal line, a short black streak above it and two streaks on the margin above anal angle; fringe dark. Hind wing dark brown, with traces of an outer dark line; fringe irregularly ocherous spotted with a dark line at its base. Expanse, 35 mm.

Cuernavaca, Mexico, July, 1906 (W. Schaus); also specimens from Guadalajara and Jalapa (Schaus collection), in all three males and three females.

Type.—Cat. No. 12993, U.S.N.M.

This species was confused in the collection with *Cropia connecta* Smith, but it differs obviously therefrom in the smaller size, broader wings, and the shape of the inner line of fore wings.

CROPIA MINTHE Druce.

This species is before me from Venezuela and French Guiana, and also a specimen from Misantla, State of Vera Cruz, Mexico, the latter sent by Mr. Müller. The male of this species has the antennæ tufted-ciliate, but without any trace of pectinations. Both wings beneath are washed with a peculiar bright brassy metallic shading, which is entirely absent in the female. It is allied to *Cropia infusa* Walker. I can not detect any difference in the shape of the inner line in these two species such as indicated in Hampson's table.^a

This is the first record of this species from Mexico.

CROPIA PERFUSA, new species.

Male antennæ tufted-ciliate, the segments somewhat lamellate beneath, but without pectinations. Lines geminate, black, the inner nearly straight, excurved only below vein 1; basal and terminal spaces of the brown ground color; median space entirely filled with black, obscuring all the markings, except a small, pale crescent

^a Cat. Lep. Phal. Brit. Mus., vol. 7, 1908, p. 263.

representing the reniform; outer line pale-filled, minutely wavy, most prominently exerted at vein 5, beyond which is a rounded black spot next subterminal line; a gray-white powdering in the subterminal space near costa; subterminal line pale, powdery and broken; fringe with a wavy black line at the base. Hind wing brown, with pale ocherous spottings near the margin. Beneath pale ocherous, the hind wing with two brown lines and a discal mark. Expanse, 38 mm.

One male, Jalapa, Mexico (Schaus collection).

Type.—Cat. No. 12994, U.S.N.M.

The specimen was in the collection under *Cropia infusa* Walker, but, though allied thereto, it differs by the solidly black median space. *Cropia infusa* is known only from Jamaica and Santa Lucia; it is a smaller species, the male antennæ with short pectinations, according to Hampson's account. I possess only females of *infusa*.

ZAZUNGA, new genus.

Antennæ of both sexes thickened, flattened, the segments doubly impressed on both sides, but otherwise smooth and without any cilia. Fore wing with vein 5 arising close to 4, accessory cell present, vein 7 from near its end, 8 and 9 stalked from its end, 10 from near its end, 11 from the cell. Hind wing with veins 3 and 4 shortly stalked, 5 from the cross vein near to 4, 6, and 7 stalked. Legs unarmed, clothed with long hair; front smooth; palpi moderate, obliquely upturned, the third joint moderate; vestiture of long hair-like scales; abdomen without dorsal tufts.

Type of the genus.—*Zazunga opinor*, new species.

ZAZUNGA OPINOR, new species.

Bluish gray; head and collar a little lighter, the tegulæ with a blackish line before the tip. Fore wing with the lines blackish, illy defined; subbasal line straight, angled inward subcostally; inner line straight from costa to median vein, thence waved to inner margin; claviform indicated by a bent line; orbicular outlined in black, with a round black center, leaving a whitish ring; a small similarly pupilled spot immediately below it; median shade dark, diffused, bent outward to touch the reniform; reniform large, outlined in black, filled with the ground color and with a narrow whitish lunule in the center; outer line indicated by a whitish shade, excurved over cell with obscure black points on the veins, edged within by a blackish line below, which forms a reentrant angle below vein 2; subterminal line whitish with venular dots, forming a black streak at costa and a longer one near anal angle; a narrow black line at base of fringe. Hind wing white. Abdomen pale gray. Antennæ ocherous. Expanse, 35 to 38 mm.

One male, Zacualpan, Mexico, September, 1909 (R. Müller); one male, Orizaba, Mexico (Schaus collection).

Type.—Cat. No. 12995, U.S.N.M.

ZAZUNGA ZETACELIS, new species.

Light gray, thinly scaled, the veins darker; a darker shade on lower half of wing, especially in the median space; lines faint, dark, the subbasal bent in to base at median vein; inner line straight across cell, waved below; orbicular a black ring with a patch of pale yellow scales below it in which there is a black dot on median vein; reniform large, filled with pale yellow and containing a central zigzag line; outer line indicated by a pale shade and black dots on the veins; subterminal line similarly indicated, forming a black streak on the costa; a wavy terminal black line. Hind wing subtranslucent and grayish, the fringe dark brown. Expanse, 38 mm.

One female, Jalapa, Mexico (Schaus collection).

Type.—Cat. No. 12996, U.S.N.M.

Genus ISCADIA Walker.

ISCADIA PURISSIMA, new species.

Head and thorax white, sprinkled with a few black scales; tegulae brown; abdomen gray, the basal tuft white and brown. Fore wing white, the scales irregularly roughened; a black patch at base on costa, covering inner line; a patch of yellow-green scales below it; a black mark above inner margin across the inner line with a smaller duplication above vein 1, marked with green scales within; inner line narrow, single, black, bent inward toward base below vein 1; median line represented by two gray marks on costa; orbicular a black dot; reniform brokenly outlined in black; outer line thick and oblique from costa to vein 5, sending a bar to outer margin, thence slender, running inward along vein 3, then sharply angled and arcuate to inner margin; beyond the line are a series of patches of green and yellow scales arranged upon a gray strongly waved line, which continues above the oblique black bar to costa; a wavy brown shade in the terminal space; a terminal black line forming dentations of the veins; fringe spotted with blackish. Hind wing pale brown, broadly blackish along the margin, the termen powdered with gray; a black line edged with white powdering starts from near anal angle, but is lost beyond. Expanse, 68 mm.

One female, Misantla, State of Vera Cruz, Mexico, November, 1908 (R. Müller); another female, in poor condition, Rinconada, State of Vera Cruz, Mexico (Schaus collection).

Type.—Cat. No. 12997, U.S.N.M.

Allied to *Iscadia similis* Druce (*Gadirtha similis* Druce),^a but the median area entirely white.

^a Ann. Mag. Nat. Hist. (7), vol. 7, 1901, p. 79.

ISCADIA DÆMONASSA, new species.

Fore wing brown-black, shading to mottled brown on the inner margin, the apex gray-white; lines slender, black, single; subbasal line waved, a very fine line along submedian fold; inner line straight to subcosta, a sharp outward tooth below, then roundedly and strongly arcuate to vein 1, where is a sharp inward tooth, then rounded to inner margin; a line along submedian fold joining the outer line; stigmata absent; outer line starting on costa near middle of wing, running along subcosta to outer fourth, then roundedly arcuate to an inward tooth on submedian fold where it joins the longitudinal line, thence to inner margin with an angle on vein 1; long black streaks on the discal venules cross the outer line; outer margin strongly wavy, the fringe concolorous with the markings. Hind wing white, the apex fuscous shaded, especially on the veins. Head, tegulae and patagia nearly black, disk of thorax brown. Abdomen gray. Beneath the wings are white, suffused and dusted with gray on the costal region. Expanse, 53 mm.

One female, Guerrero, Mexico (J. Doll); another female, Jalapa, Mexico (Schaus collection).

Type.—Cat. No. 12998, U.S.N.M.

This species is not an *Iscadia*, as the last joint of the palpi is short, and is only temporarily placed in the genus.

Genus *MELIPOTIS* Hübner.*MELIPOTIS MOSCA*, new species.

Thorax dark brown or reddish brown; abdomen light gray. Fore wing dark brown with a purplish tint, the wing narrow and trigonate in both sexes; subbasal line indicated by black spots; a rather broad pale brown oblique shade runs from the basal third of costa to the middle of inner margin; from this a similarly colored area runs below the cell, and curves up beyond it, forming a point on vein 6 and reaching close to the costa; this area is shaded around with black and narrowly edged by a black line except on the side where it borders the cell; the inner black border is edged basally by the narrow black inner line, which is oblique and parallel to the pale area and forms an inward tooth on subcosta and submedian; orbicular a small pale yellowish point; reniform a small pale yellowish dash in the cell and another at its end, the two converging somewhat costally; subterminal line, narrow, pale, edged within by a row of black cusp-shaped shadings, with a narrow outer brown edge that widens as it touches the costa, reaching the apex; terminal space almost as light as the mesial marking; a fine, wavy, terminal black line. Hind wing white at the base, the outer half shaded with black, the fringe pale. Expanse, 34 mm.

Four females and one male, Mexico City, Mexico, September, October, and November, 1909 (R. Müller).

Type.—Cat. No. 12999, U.S.N.M.

The sexes are essentially alike, the male having the mesial pale area a little narrower and straighter than in the female and more distinctly marked with dark shade lines.

Family LASIOCAMPIDÆ.

Genus METANASTRIA Hübner.

METANASTRIA GUSTANDA, new species.

Reddish gray, the terminal space more gray, with a gray streak from the base through the cell, indistinctly joining the terminal grayish area; four straight lines across the wing, the first two erect, the outer two more oblique, the first, second, and fourth edged outwardly with brown, the third inwardly so edged; a white discal point; subterminal line irregular, composed of pale oblique streaks between the veins. Hind wing dark red. Abdomen red above and below, the sides and tip brown. Expanse, 73 mm.

One male, Zacualpan, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 13000, U.S.N.M.

Allied to *Metanastria championi* Druce, but with narrower wings and differently colored.

Genus TOLYPE Hübner.

TOLYPE CELESTE, new species.

White, the thorax marked with gray, the abdomen ringed with gray. Fore wing with a grayish overcast, and crossed by wavy dark gray lines; three lines on the basal part of the wing, separated by two linear lines of the ground color; median space wide above, including a black sublunate discal mark, narrow below and cut off by the approximating lines into a round space below vein 2; four lines beyond, the first two separated by a linear white line, the others waved, confused, subconfluent, limited by a white subterminal line that is dislocated on all the veins below vein 5 and forms a patch between 5 and 6; terminal space filled in with gray; fringe spotted with gray. Hind wing white, a gray mark at anal angle. Expanse 43 mm.

One female, Misantla, Mexico, November, 1909. (R. Müller).

Type.—Cat. No. 13001, U.S.N.M.

Allied to *Tolyte infernalis* Schaus, but the hind wings are white instead of dark gray.

TOLYPE ADOLLA, new species.

White. Fore wing with broad pale gray subbasal line; two median lines, well separated, nearly straight, cut by the white veins; a subterminal broad diffused gray line. Expanse, 25 mm.

One male, Misantla, Mexico, May, 1909 (R. Müller).

Type.—Cat. No. 13002, U.S.N.M.

Allied to *Tolyte albula* Druce, but the median lines are straighter, darker, and farther apart.

TOLYPE MOTA, new species.

One male, Coatepec, Mexico (Schaus collection).

Type.—Cat. No. 13004, U.S.N.M.

Allied to *Tolyte albula* Druce, but with more robust body and longer abdomen; the lines of the fore wing are essentially as in *albula*, but darker, especially on the coastal third, the median lines somewhat more separated. Expanse, 26 mm.

TOLYPE DOLLIA, new species.

White. Fore wing with two or three little black specks on the costa of which one situated subapically is rather large; from it a row of minute black specks on the veins crosses the wing; a little black speck at base of vein 2. Expanse, 32 mm.

One male, Colima, Mexico (J. Doll).

Type.—Cat. No. 13003, U.S.N.M.

The woolly white body and wings almost unmarked make the species look like a *Carama*.

Genus CLISIOCAMPA Curtis.**CLISIOCAMPA ONISSA, new species.**

Fore wing ochereous, thickly powdered with brown; lines brown, a little lighter edged away from the median space. Hind wing brown, with traces of an outer darker line. Thorax and abdomen brownish shaded on ochereous. Expanse, 30 mm.

Five males, Zacualpan, Mexico, April and August, 1909 (R. Müller).

Type.—Cat. No. 13005, U.S.N.M.

This is the first *Clisiocampa* from the region below the Mexican table-land. Mexico City, on the table-land, has two species, *C. azteca* Neumoegen and *C. luteimargo* Dyar, which are varieties or derivative species of *C. fragilis* Stretch, which is well distributed through the arid regions of the United States and has many forms and variations. The genus comes from the north, from a former circumpolar fauna, a number of species being known in Europe and Asia.

Genus CLAPHE Walker.

CLAPHE CONSOLABILIS, new species.

Thorax and abdomen dark brown, the edges of tegulæ and patagia overhanging the wings lined with pale; abdomen reddish at the sides. Fore wing with the basal space ocher, blotched with brown on the costa and limited outwardly by a double dark-brown line; rest of the wing pale gray, the veins narrowly lined with brown, a double row of dark dots in the position of the outer line and a faint wavy, linear submarginal line. Hind wing with the inner area broad brown, the basal space above this shade dark brown, limited by a blackish line, the rest pale gray with double clouded darker line. Expanse, 32 mm.

Four males, Misantla, Orizaba and Coatepec, Mexico, May and September, 1909, and September, 1908 (R. Müller).

Type.—Cat. No. 13006, U.S.N.M.

Allied to *Claphe albidifascia* Walker, but the outer area paler gray and the base not overlaid with dark brown. At first sight the species looks more like *Claphe gera* Schaus^a and *C. limba* Druce,^b but it is really not so closely allied to these in spite of the similar coloration of the base of the wing.

CLAPHE CACOPASA, new species.

Dark brown, the face gray, the front of the thorax lighter than the posterior part. Fore wing much elongated, dark brown, a little variegated with black near the base but without distinct lines; a broad pale ray from end of cell to outer margin; a narrow submarginal line, black, slightly wavy, near to and parallel with the margin. Hind wing much produced toward the anal angle, dark brown, with a double, pale shaded line on the upper half outwardly; a pale wavy line very close to the margin on the upper half only. Expanse, 28 mm.

One male, Misantla, Mexico, April, 1909 (R. Müller).

Type.—Cat. No. 13007, U.S.N.M.

Family NOTODONTIDÆ.

Genus HETEROCAMPA Doubleday.

HETEROCAMPA ANDRODORA, new species.

One female, Misantla, Mexico, September, 1909 (R. Müller); also another female from the same place, October, 1909 (R. Müller), and four females, Cuernavaca, Cordoba, and Salina Cruz, May, August, and September, 1906 (W. Schaus).

Type.—Cat. No. 13008, U.S.N.M.

^a Proc. U. S. Nat. Mus., vol. 29, 1905, p. 313.

^b Biol. Centr.-Amer., Lep. Het., vol. 2, 1887, p. 206.

This form so closely resembles *Heterocampa cubana* Grote that I am unable to make a differential description and refer to Grote's comparisons and figure.^a It is possibly the same species. Other Cuban species are known from Mexico; but I prefer to keep it distinct for the present. A single male specimen from Orizaba, which was in the collection as the male of *Heterocampa gelduba* Schaus, undoubtedly belongs here. It is not in perfect condition, but appears to have the slender angled line that runs up beyond the discal mark less dark and sharply defined than in *cubana*. The same difference appears in the females also. Also very closely allied to these species is *Heterocampa aroënsis* Schaus from Venezuela and British Guiana, which resembles more *cubana* in the character of the line mentioned. I presume that these three forms are really only local races of one species.

HETEROCAMPA GELDUBA Schaus.

This species was described from Mexico, and seems to be not uncommon. I have above taken away the only male specimen, but am able to supply another, which I believe is the true male. The specimen comes from Mr. Müller, and was taken in Orizaba in June, 1908. It is easily distinguished from the foregoing by the wing-shape. Both sexes have shorter, squarer wings than in *androdora*, *cubana*, or *aroënsis*.

Genus NAGIDUSA Walker.

NAGIDUSA SUAVIS, new species.

Body dark gray. Fore wing bluish gray with slight violaceous tint, the costa shaded with ochereous and brown; base shaded with dark gray and brown, a narrow black line at base on submedian fold; inner line showing traces in brown; discal mark a brown curved line surrounded by ochereous shading; outer line indicated by brown dots on the veins, doubled, filled with ochereous, inclosed in an ochereous and brown shading on the costa; veins with short black dashes in the subterminal space, followed by dots. Hind wing whitish, the fringe gray brown; veins 6 and 7 marked in brown and crossed by a faint white shade outwardly. Expanse, 40 mm.

One male, Zacualpan, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 13009, U.S.N.M.

Genus NAPREPA Walker.

NAPREPA HOULA, new species.

Head and thorax dark brown, the tuftings tipped with light scales. Abdomen light brown, becoming dark and tufted at the tip. Fore

^a Proc. Ent. Soc. Phila., vol. 5, 1865, p. 252.

wing brown; inner line dark brown, strongly waved, produced into six finger-shaped processes, the one in the lower part of the cell the longest, the two lower ones with sharp tips; a brown curved shade beyond the middle, from beyond middle of costa to tooth on inner margin; outer line dark brown, with white tuftings on the veins, the portion above vein 4 strongly produced inward between the veins in four finger-shaped processes that reach to the cell; an especially distinct white tufting on vein 1; a dark shade between veins 3 and 4; subterminal line indicated, black, narrow, waved; a black line at base of fringe, broken into a series of cusps. Hind wing light brown with a slightly wavy extra-mesial line, pale, dark-edged within, forming above the anal angle a black blotch succeeded by white scales, the whole marking powdery. Expanse, 83 mm.; female, 110 mm.

One male, two females, Coatepec, Mexico (Schaus collection); Jalapa, Mexico (Schaus collection); Mirador,^a Mexico, May, 1908 (R. Müller).

Type.—Cat. No. 13010, U.S.N.M.

Allied to *Naprepa cyllota* Druce, but without the black and white rings on the abdomen.

Genus PSEUDHAPIGIA Schaus.

PSEUDHAPIGIA MISERICORDIA, new species.

Thorax dark brown; abdomen gray, lighter at base and tip. Fore wing dark brown, somewhat bronzy, irregularly shaded or almost mottled with blackish, which terminates with a wavy outline in the middle of the subterminal space; inner line oblique from basal fourth of costa to middle of inner margin, single, blackish, indistinct; discal marks an orbicular in upper part of cell and larger reniform in lower angle, filled with dark red-brown without metallic scales, the two in an oblique line which would run from inception of inner line on costa to termination of vein 3 on outer margin; outer line straight from outer fourth of costa to inner margin beyond the tooth, bent a little on vein 1 only, blackish without, pale within; subterminal line black, slender, produced between the veins into a series of loops; marked with silvery scales subapically; terminal space darkly shaded near apex. Hind wing brown, unmarked, the veins a little darker. Expanse, 60 mm.

One male, Santa Rosa, Mexico, August, 1906 (W. Schaus); also three males and four females, Cuernavaca, Mexico, July and August, 1906 (W. Schaus).

Type.—Cat. No. 13011, U.S.N.M.

^a The locality is so given on the specimen, but the location is unknown to me.

Allied to *Pseudhapigia xolotl* Schaus, but larger, darker and without silvery scales on the discal marks, which are also further apart and more obliquely placed. The antennæ of the female have shorter pectinations than in *xolotl*.

I place this species in *Pseudhapigia*, although it might perhaps be better placed in the next genus. The antennæ are pectinated within a few joints of the tip, while veins 3 and 4 of hind wing are approximate at origin or only slightly separated.

HAPIGIODES, new genus.

Near *Pseudhapigia* Schaus, but veins 3 and 4 of hind wings apart and the antennæ pectinated on the basal two-thirds only. The genus falls in Schaus's table with *Colax* Hübner, from which it is readily separated by the prominent tooth on the inner margin of fore wing.

Type of the genus.—*Hapigia xolotl* Schaus.

HAPIGIODES XOLOTL Schaus.

Hapigia xolotl SCHAUS, Proc. Zool. Soc. Lond., 1892, p. 339.

Pseudhapigia xolotl SCHAUS, Trans. Ent. Soc. Lond., 1901, p. 343.

This species has hitherto been known only from females. The type was a female from Coatepec, Mexico, and there are before me three other females from Paso San Juan, State of Vera Cruz. Lately, however, a male has been obtained by Mr. Schaus on the Sixola River in Costa Rica.

HAPIGIODES FREDERICA, new species.

Head and thorax rusty brown; abdomen blackish gray. Fore wing rusty brown at the base to beyond the tooth on inner margin, lilacine shaded beyond; subbasal line erect on inner margin, black, slender, pale-edged within; inner line similar, forming arcs on the veins, the points inward, pale-edged without; discal marks, orbicular and reniform, approximate, oblique, dark brown; outer line straight, narrow, dark without, pale within, bent on vein 1; subterminal line blackish, forming a series of loops between the veins, marked with silvery scales at apex. Hind wing whitish, a little soiled with fuscous. Expanse, 54 mm.

One male, Cordoba, Mexico, February 17, 1908 (F. Knab).

Type.—Cat. No. 13012, U.S.N.M.

Easily distinguished from its allies by the wing shape, the outer margin being prominent at veins 5 and 6, straight or slightly concave below, the tooth on inner margin very large, very much as in *Hapigia accipiter* Schaus, though the species is smaller.

Family GEOMETRIDÆ.

Genus OENOTRUS Druce.

OENOTRUS PHANERISCHYNE, new species.

Black; collar, edge of patagia, and front ocher yellow; fore coxæ, pleura, and sides of abdomen washed with crimson. Wings black, the fore wings with a large basal area, occupying three-fourths of the length of the wing crimson, the inner margin narrowly black; hind wing with a crimson patch on costa. Beneath this area is repeated on fore wing and runs to apex; beyond it the wing is black without markings; hind wings without markings. Expanse, 28 mm.

One male, Zacualpan, Mexico, June, 1909 (R. Müller); another male, Guadalajara, Mexico (Schaus collection).

Type.—Cat. No. 13013, U.S.N.M.

Allied to *Oenotrus dispar* Walker but the under side of the wings without yellow lines and the hind wing marked with red above.

Genus HETERUSIA Geyer.

HETERUSIA SUBSTRIATA, new species.

Black; collar, edges of patagia, abdominal rings, palpi, and fore coxæ yellow; tarsi ringed with white. Wings black, the fore wing with a large oblique medial orange yellow patch, separated from costa by a black line and reaching down to submedian fold; an oblique orange dash before apex. Hind wing with the discal area yellow, dentate on its outer edge and with a black dash at base. Beneath the yellow area of fore wing is repeated, the costa buff from thence to the base, interlined with red; a pale buff band across the apex, lined with red on each side. Hind wing with the costa and the whole inner area pale buff, lined with red; the inner area extends to the base of the fringe and is bordered with red and lined with it between the veins below vein 3 and in the cell; the outer edge is narrowly buff and there is inclosed in the red area two small confluent black spots. Expanse, 25 mm.

One male, Zacualpan, Mexico, July, 1909 (R. Müller); twenty specimens, Popocatepetl Park, Mexico, 8,000 feet, June, 1906 (W. Schaus); one male, Iguala, State of Guerrero, Mexico, June, 1906 (W. Schaus); one male, Morelos, Mexico, 7,000 feet, June, 1906 (W. Schaus).

Type.—Cat. No. 13014, U.S.N.M.

Nearest to *Trochiodes cydonia* Druce, figured in the *Biologia Centrali-Americana*, pl. 58, figs. 16, 17.

Genus COENOCALPE Hübner.

COENOCALPE PENGUINIFERA, new species.

Body dark ocher, face and spots on vertex white, edges of collar and patagia pale yellow. Wings above ocher yellow, shining, the fore wing stained with brown at apex; fringe white, stained with brown at the ends of the veins. Under side of fore wing yellow, the apex brown, containing a dislocated, submaculate, silvery band and a whitish costal dash within; hind wing pale brown with silvery white markings; a curved subbasal band, reaching costa and running broadly to base; a spot on inner margin; a curved median band, crossed in the middle by a broad stripe which expands in the cell into a capitate mark with a point toward costa and close to outer margin is trilobate; a blotch at apex and a bar from tornus showing two teeth outwardly on the veins. Fringe as above. Expanse, 28 mm.

One male, Zacualpan, Mexico, September, 1909 (R. Müller); one male, Cuernavaca, Mexico, June, 1906 (W. Schaus).

Type.—Cat. No. 13015, U.S.N.M.

Genus DICHORDA Warren.

DICHORDA APLAGARIA, new species.

Wings green, the costa mottled with dark red; lines straight, white, rather broad, the inner nearly perpendicular to inner margin, the outer parallel to outer margin; hind wing with the line straight from costa to above anal angle; discal dots of both wings small, black. Expanse, 22 mm.

One male, one female, Guadalajara, Mexico (Schaus collection); another male, Mexico City, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 13016, U.S.N.M.

Near to *Dichorda consequaria* Hy. Edwards, but smaller, the lines less rigid, the outer one subparallel to outer margin, arising on the costa far from the apex; the lines also have scarcely any olivaceous edging, and the veins outwardly are not washed with white.

Genus OXYDIA Guenée.

OXYDIA SCHEMATICA, new variety.

Three males, Orizaba, Mexico (R. Müller; Schaus collection); also one male, Misantla, Mexico, November, 1908 (R. Müller).

Type.—Cat. No. 13017, U.S.N.M.

A variety, or local race of *Oxydia crocallinaria* Oberthur, smaller, without the ocherous shading, paler. The markings are essentially the same, though the submarginal black shade is generally reduced or absent.

Genus *POLLA* Herrich-Schaeffer.*POLLA HEMERARIA*, new species.

Tawny brown, collar and costa at base shaded with creamy white; lines on fore wing narrow, powdery white, partly dark edged; inner line straight, crossing the wing before origin of vein 2; outer line curved from close to apex to inner margin at outer third; a white shading at outer fourth of costa, running onto the adjoining veins; wing sparsely irrorate with black, with black discal dot and subterminal spots on veins 2, 3, and 4. Hind wing with discal dot and traces of mesial line and subterminal spottings. Fringe narrowly white tipped. Expanse, 35 mm.

One male, Misantla, Mexico, September, 1909 (R. Müller).

Type.—Cat. No. 13018, U.S.N.M.

Allied to *Polla praelataria* Herrich-Schaeffer, but with the lines well apart, the inner one erect and not angled outward to the discal dot. This may be *Polla celeraria* Walker. Walker's description apparently agrees, but I have no specimen that has been directly compared with Walker's type.^a His locality is Villa Nova [Brazil], which would indicate a wide distribution if the species are the same.

Genus *PYRINIA* Hübner.*PYRINIA MINSERA*, new species.

Rusty brown, the area before the outer line on both wings a little lighter, showing a yellowish ground, heavily overlaid with rusty mottlings; indications of a discal dot; outer line on both wings straight, dark, with a leaden shade, on fore wing at outer third and parallel to outer margin, on hind wing near the middle. Beneath yellow, overlaid with rusty brown mottlings, the basal and terminal spaces of fore wing nearly filled by them, the hind wing showing a mesial line and heavy mottlings at base and terminally. Expanse, 25 mm.

One male, Zacualpan, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 13019, U.S.N.M.

Allied to *Pyrinia castana* Dognin from Ecuador and Bolivia, but the fore wing with the outer margin less straight and oblique and the markings on the under side of the wings heavier, especially basally.

Genus *BASSANIA* Walker.*BASSANIA UMBRIMARGO*, new species.

Dull clay-color; fore wing a little brownish shaded at base, the margins of both wings broadly shaded with dark gray, limited by a narrow purplish black line; on the fore wing the limiting line arises

^aCat. Brit. Mus., 1869, p. 98.

on the outer third of inner margin and runs parallel to outer margin, then curves and reaches costa at apex; on the hind wing the line runs straight across at the outer third; discal dots minute, black. Expanse, 41 mm.

One male. Zacualpan, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 13020, U.S.N.M.

Allied to *Bassania neropia* Druce, but the course of the outer line is different.

Genus STENASPILATES Packard.

STENASPILATES RECTISSIMA, new species.

Fore wing dark reddish brown, minutely speckled with black atoms, the costa broadly and diffusedly pale; lines straight, approximately parallel, diverging a little toward costa, whitish, powdery, edged with black toward the median space; discal dot small, black, near to the costa. Hind wing brownish ochereous, shading to dark brown toward the anal angle; a straight blackish line across the wing beyond the middle, edged outwardly with pale toward the inner margin; discal dot small, black. Expanse, 32 mm.

One female, Orizaba, Mexico, July, 1909 (R. Müller).

Type.—Cat. No. 13021, U.S.N.M.

Allied to *Stenaspilates apapinaria* Dyar from southern California, but the lines all much straighter, while the color is darker.

Genus ENDROPIA Guenée.

ENDROPIA UNDULARIA, new species.

Clay color, irrorated with dark brown; lines of fore wing wavy, the outer followed by a purplish shade, that largely fills in the subterminal space below; subterminal line wavy, similar to the others, followed by a brown cloud below the middle of the inner margin; discal dot small, black. Hind wing with the mesial line distinct, wavy, the submarginal line more strongly waved and narrower. Expanse, 40 mm.

One male, Zacualpan, Mexico, April, 1909 (R. Müller).

Type.—Cat. No. 13023, U.S.N.M.

Much resembles the female of *Endropia mattearia* Schaus, except for the wavy lines. Both these species are allied to the North American *Metanema quercivoraria* Guenée.

Genus SELENIA Hübner.

SELENIA VEDA, new species.

Fore wing shaded with reddish brown or dark brown, except the costa and terminal space, which are lighter; the dark shade reappears more or less distinctly on the margin; outer line distinct, incurved at vein 2, white, narrow, relieved by an intensification of the dark shading

within it; an oblique dark band on the middle of the costa is sharply angled opposite the cell and proceeds to inner margin close to outer line, but the part below the angle is often lost in the general dark shading; a similar angled subbasal line shows in some of the specimens, but it is generally still fainter than the mesial one; an ill defined dark discal mark. Hind wing pale clayey or whitish, sparsely irrorate with brown; an outer straight dark line and obscure discal dot; the shading is darker at the anal angle. Expanse, 32 to 37 mm.

Four males, two females, Mexico City, Mexico, February, April, June, 1909, October, December, 1908 (R. Müller).

Type.—Cat. No. 13024, U.S.N.M.

Allied to *Selenia belisama* Druce, but with a differently shaped outer line.

Genus *TORNOS* Morrison.

TORNOS UMBROSARIUS, new species.

Thorax clay color; abdomen dull black. Fore wing clay color, the outer third of the wing overlaid with black except costally, a streak running into the rounded discal dot, and another along submedian fold; lines obsolete, the outer indicated by dots. Hind wing overspread with dull black, a faint, curved, wavy, mesial line alone visible, pale without, dark-edged within. Expanse, 34 mm.

One female, Orizaba, Mexico, January, 1909 (R. Müller); also four females from Orizaba (Schaus collection).

Type.—Cat. No. 13025, U.S.N.M.

The specimens from the Schaus collection were considered by Mr. Warren to be *Tornos scolopacinaris* Guenée; but I have seen no specimens of this well-known North American species which at all approach the Mexican form. Hulst described *Tornos abjectarius* from Arizona, a type of which is before me, but it is only the dark form, *robiginosus* Morrison, which I can easily match in my Texan material. Hulst also described *Tornos cinctarius* as a variety of *scolopacinaris*. I have no type of this before me, but from the description it seems much the same as *Tornos quadripunctata* Warren, a distinct species. No locality is given for *cinctarius*; but Pearsall has supplied Florida and Georgia. *Quadripunctata* I have from Guadalajara, Jalapa, and Orizaba, Mexico. A comparison of types will have to be made, though it is unlikely that the species are really the same.

Genus *CENOCHARIS* Hulst.

CENOCHARIS FEMINARIA, new species.

Fore wing gray, powdery, sprinkled with light and dark scales; inner line black, wavy, bent on median vein; discal mark indicated by a slightly darker cloud; outer line black, wavy, nearly even in its course, from outer fourth of costa to middle of inner margin. Hind

wing pale gray, darker on the margin, the inner margin powdery gray; traces of a pale mesial line. Expanse, 35 mm.

One female, Tehuacan, Mexico, September, 1909 (R. Müller).

Type.—Cat. No. 13026, U.S.N.M.

Allied to *Cænocharis elongata* Hulst from Texas, but larger, powdery gray, not uniform lilaceous gray, and the lines farther apart.

Genus MERIS Hulst.

MERIS MEXICOLA, new species.

Dark gray, powdery, intermixed with olivaceous; inner line black, diffused, curved; a large clouded discal spot; outer line broad, black, narrowly excurved at vein 4, inwardly dentate on the veins, roundedly curved outwardly, the points of the dentations filled in with white dots; traces of a submarginal black line; a row of black points between the veins at the base of the fringe. Hind wing pale at the base, outwardly shaded with gray and olivaceous; a rounded dark discal mark; traces of an outer dark line, showing only on the inner margin. Expanse, 35 mm.

Two males, Mexico City, Mexico, December, 1909 (R. Müller).

Type.—Cat. No. 13027, U.S.N.M.

Allied to *Meris alticola* Hulst from New Mexico, but the wings are greener and marked with distinct lines; the pectinations of the antennæ are much shorter.

Family MEGALOPYGIDÆ.

Genus MEGALOPYGE Hübner.

MEGALOPYGE LAMPRA, new species.

Dark purplish brown, head, tegulæ and patagia with large yellowish white spots, abdomen indistinctly ringed with white. Fore wing dark brown on the basal half, the veins in and above the cell and an ellipse below the median vein outlined in white; the dark space is sharply limited at the end of the cell, thence incurved and outward to tornus; outer area with white lines on the veins and in the interspaces, forming a continuous white line next to the dark area, narrowing outwardly, the margin again brown; a dark spot above vein 6. Hind wing whitish, the veins narrowly brown; outer margin narrowly and inner margin broadly brown. Expanse, 30 mm.

One male, Misantla, Mexico, March, 1909 (R. Müller); one male, Santa Cruz, Mexico (H. Schwarz).

Type.—Cat. No. 13027, U.S.N.M.

This appears to be the species figured in the Biologia Centrali-Americana (pl. 86, fig. 6) as *Megalopyge radiata* Schaus. However, *radiata* is quite another species, having no white spots on the collar.

It is known to me by the single female type from Brazil. *M. lampra* is allied to *M. superba* Hy. Edwards, but differs in the markings on the outer part of the wing.

MEGALOPYGE CYRTOTA, new species.

White, the long hairs tipped with brown. Fore wing white, shaded with brown, the white showing most distinctly on the long curled hairs of subterminal area; a rounded triangular dark patch on basal half of inner margin, composed of brown and purplish black scales; a black spot at end of cell and another between it and the margin. Hind wing creamy white. Expanse, 32 mm.

One female, Mexico City, Mexico, June, 1909 (R. Müller.)

Type.—Cat. No. 13028, U.S.N.M.

The pattern of coloration is as in *Megalopyge lapara* Schaus. The present species is small and slender, the fore wings considerably elongated.

MEGALOPYGE TRUJILLINA, new species.

Seven females, Cuernavaca, Mexico, July, 1906 (W. Schaus.)

Type.—Cat. No. 13029, U.S.N.M.

Closely allied to *Megalopyge trujillo* Schaus, and possibly not specifically distinct therefrom. The specimens are somewhat smaller and show a yellowish olivaceous tint on the outer part of the wing, which is not nearly so distinct in *trujillo*. The whitish submarginal line on the wing is more or less well indicated, in the series considerably more distinct than in *trujillo*, while the whitish patch at the base of the wing is less distinct and contrasted, due largely to the general paler tint of the coloration.

MEGALOPYGE CODIOPTERIS, new species.

Five males, ten females, Cordoba, Jalapa, and Cuernavaca, Mexico (W. Schaus).

Type.—Cat. No. 13030, U.S.N.M.

Again allied to *Megalopyge trujillo* Schaus and to the preceding, but more divergent. The yellow color is still more intensified, forming the ground color, though still overwashed with brownish to the margin. The form is nearest to *trujillina*, being the same but lighter and more yellow, nearly intermediate between *trujillina* and *Megalopyge defoliata* Walker. One of the specimens is in fact labeled "*defoliata*," but I take that species to be the still lighter form in which the margin of the wing is clear yellow, the brown shading having wholly or largely retreated therefrom. In *defoliata*, too, the basal shadings are darker, having more of a blackish than purplish tint.

MEGALOPYGE BISSESA, new species.

Head and thorax orange yellow, more or less intermixed with brown. Fore wing yellow, the basal two-thirds overspread with brown, mottled with purplish, especially costally, with a brown semidetached spot at the fork of veins 7 and 8. Hind wing with light-brown shading on the basal half. Expanse, male, 30 mm.; female, 45 mm.

Ten males, two females, Cuernavaca, Mexico, August, 1906 (W. Schaus); Santa Rosa, Mexico, July, 1906 (W. Schaus); also one male, southern Arizona (E. J. Osler), and one female, Oracle, Arizona, July 22 (H. G. Hubbard).

Type.—Cat. No. 13031, U.S.N.M.

Allied to *Megalopyge ornata* Druce and *M. opercularis* Smith and Abbot, but distinguished from both by the clear yellow margin of fore wing, which is not encroached upon by brown shadings.

MEGALOPYGE LANATA Stoll.

This species is subject to rather marked local variations. The Mexican form is small and dark, the black marginal shadings not separated, but joined to the submarginal intervenular black streaks. The hind wings are dark, in the female sometimes solidly blackish. Stoll's original figure of the female may be recognized, although I have never seen a specimen in which the median markings were so reduced as there represented. The figure of the male is wholly unrecognizable. *Phalaena citri* Sepp is clearly the same species with the median markings well developed but not strongly joined to the basal ones. I am unable, however, to accept the reference of *Phalaena Bombyx tharops* Stoll to this species, as I can not reconcile any male specimen before me with Stoll's figure. It probably represents some species at present unrecognized.

MEGALOPYGE SUPERBA Edwards.

This species is recorded in the Biologia Centrali-Americana as *Gasina albicollis* Walker. It is, no doubt, only a race of *Megalopyge albicollis* Walker, but the wings have very considerably less of white, and I think the name *superba* may be retained for the Mexican form. I have this same form from British Honduras and Costa Rica.

Genus PODALIA Walker.**PODALIA MISANTLA, new variety.**

Two males, Jalapa, Mexico (Schaus collection); Misantla, Mexico, March, 1909 (R. Müller).

Type.—Cat. No. 13032, U.S.N.M.

This is the Mexican form of *Podalia orsilochus* Cramer. The true *orsilochus* from the Guianas is very dark, the markings on the fore

wing being dark gray-brown, the hind wing of the male solidly black. Specimens from Rio Janeiro, Brazil, are essentially the same, but have a little white on the edge of the hind wing, cutting off a row of marginal dots (form *vesta* Walker female = *dorsimacula* Walker male). In the Mexican specimens the markings, while essentially the same, are lighter and more grayish, only the spot at base of costa and the subbasal spots in the submedian space appearing dark. The hind wings are white in the cell and beyond, brown shaded below, the veins darker, with a diffused white submarginal shade, cutting off a row of marginal gray spots. The form is allied to *Podalia major* Schaus, but this is marked with a still paler gray, while the hind wings are largely white, only brown-shaded below the cell to anal angle. *Misantla* is the most divergent form, as the markings are more separated and tend to be broken up into spots. In both *orsilochus* and *major* there is a continuous broad median shade curving outward in the cell to costa; in *misantla* it is broken up into separate markings and does not give the appearance of a continuous shade. *Orsilochus* has the hind wings very dark, *major* has them very pale, while *misantla* is intermediate in this respect.

Family DALCERIDÆ.

Genus ANACRAGA Dyar.

ANACRAGA SOFIA, new species.

Fore wing pale cream color; a brown cloud subbasally in submedian fold; a faint brown clouding across the middle of the wing and subterminally; discal dot round, dark brown. Hind wing whitish, shading to cream color along the inner margin. Expanse, 20 mm.

One female, Cuernavaca, Mexico, August, 1906 (W. Schaus).

Type.—Cat. No. 13036, U.S.N.M.

Genus ACRAGA Walker.

ACRAGA CARETTA, new species.

White; fore wing with a chocolate-brown shaded submarginal band, staining the anal angle and becoming faint and finally lost above; discal cross-veins and origins of veins 2 and 3 finely marked in brown. Expanse, male, 18 mm.; female, 27 mm.

One female, Misantla, Mexico, June, 1909 (R. Müller); one male, Chiriquicito, Panama (W. Schaus).

Type.—Cat. No. 13037, U.S.N.M.

Family CASTNIIDÆ.

Genus CASTNIA Fabricius.

CASTNIA HECHTIAE, new species.

Gray, the fore wing shaded with black at base below cell and in an angular mark at end of cell; a white band, starting near base, runs along above median vein to origin of vein 2, thence fills the interspace 2 and 3 and runs obliquely upward toward costa just beyond the cell, terminating at vein 7. Hind wing orange-red, darker shaded in cell and submarginally; a strongly bent black band at end of cell, a submarginal row of pear-shaped spots and the margin narrowly black, the black running inward a little on the veins. Expanse, 65 mm.

One male, Tehuacan, Mexican, June, 1909, "on Hechtia" (R. Müller).

Type.—Cat. No. 13038, U.S.N.M.

Family COSSIDÆ.

Genus XYLEUTES Hübner.

XYLEUTES STRIGIFER, new species.

White; fore wing densely covered with erect black strigæ about as long as the interspaces between the veins, the dots larger and heavier along the costal edge; an agglomeration of black scales on the discal cross vein. Hind wing more faintly and sparsely strigose, but similar. Expanse, 33 to 42 mm.

Four males, Orizaba, Mexico, June, 1909 (R. Müller); Santa Cruz, Mexico (H. Schwarz).

Type.—Cat. No. 13039, U.S.N.M.

The specimens resemble Herrich-Schaeffer's figure of *Zeuzera canadensis* without the dark shadings and with the discal mark added. The hind wings also are more strigose.

Genus ZEUZERA Latreille.

ZEUZERA RAMUSCULA Dyar.

Zeuzera ramuscula DYAR, Sci. Bull., Brooklyn Inst., vol. 1, pt. 8, 1906, p. 8.

A large specimen is before me, the markings smooth and powdery, but the same species, I believe. Iguala, State of Guerrero, Mexico, June, 1906 (W. Schaus). The species was described from Brownsville, Texas.

Genus *MIACORA* Dyar.*MIACORA DIFFIDENS*, new species.

Head and thorax soiled rusty white, abdomen blackish gray. Fore wing whitish gray in ground, overlaid with drab gray except below median vein and beyond end of cell; a red-brown shade in submedian space across vein 2; strigæ black, rather dense, but obscured by the dark ground, a conspicuous streak from near anal angle up perpendicularly to costa and another submarginal one running down from near the apex. Hind wing brownish black. Expanse, 52 mm.

One male, Zacualpan, Mexico, August, 1909 (R. Müller).

Type.—Cat. No. 13040, U.S.N.M.

Allied to *Miacora tropicalis* Schaus, but smaller and darker.

Genus *GIVIRA* Walker.*GIVIRA FLAVESCENS* Dognin.

Eugivira flavescens DOGNIN, Ann. Ent. Soc. Belgique, vol. 48, 1904, p. 122.

A specimen from Santa Rosa, State of Vera Cruz, Mexico (W. Schaus), agrees well with a specimen from San Salvador labeled by Mr. Dognin.

Genus *HYOPTA* Hübner.*HYOPTA SALOME*, new species.

Light gray, the abdomen dark. Fore wing mottled with white on the gray ground, especially at end of cell, below median vein and in a double series of submarginal spots; no strigæ; a rounded triangular brown-black spot in submedian space below center of vein 2. Hind wing powdered with dark gray, lighter between the veins. A row of terminal black dots on both wings. Expanse, 33 mm.

One male, Misantla, Mexico, May, 1909 (R. Müller).

Type.—Cat. No. 13042, U.S.N.M.

Allied to *Hypopta pulverosa* Hampson from Santa Lucia, West Indies, but without the coarse strigæ. The antennæ in both species are very shortly pectinated.

HYOPTA CHILODORA, new species.

Dark gray. Fore wing gray, powdery, the costa strongly dusted with white; two lines across the wing of raised scales, white within, blackish without; inner line slightly oblique, crossing the end of the cell, where it is somewhat bent; outer line a little more oblique, situated submarginally. Hind wing a little lighter gray, unmarked. Expanse, 31 mm.

Five males, two females, Mexico City, Mexico, February, March, and November, 1908, and February, 1909 (R. Müller).

Type.—Cat. No. 13043, U.S.N.M.

The antennæ of the male have long pectinations.

Genus TRIGENA Dyar.

TRIGENA AMAROSA, new species.

Dark gray, base of thorax and base of abdomen with tufts of broadly spatulate brown scales. Fore wing gray, paler and more whitish through the middle of the wing, tinged with rusty brown in the apical region; an inner curved black line, nearer the base on inner margin than on costa, edged on both sides with rusty brown; the wing is dusted with rusty brown and with faint gray strigæ, the latter becoming blackish and distinct subterminally, forming an irregular line, which broadens into a reticulated area near the costa; a distinct but irregular median line below the cell, edged with rusty brown. Hind wing white, translucent, not reticulate, but dusted with gray broadly on inner margin. Expanse, 37 mm.

One male, Cuernavaca, Mexico, November, 1906 (W. Schaus).

Type.—Cat. No. 13044, U.S.N.M.

Similar in pattern of markings to *Trigena parilis* Schaus from Brazil, but of a very different color.

Genus ARBELA Moore.^a

ARBELA NAIS Druce.

Arbela nais DRUCE, Biol. Centr.-Amer., Lep. Het., vol. 2, 1898, p. 450.

Described from Costa Rica. I have a specimen from Cuernavaca, Mexico, July, 1906 (W. Schaus).

Family PYRALIDÆ.

Genus STENOPHYES Lederer.

STENOPHYES DISPARILIS, new species.

White, translucent; fore wing of the male greatly elongated, of the female much less so, but with pointed apex. Fore wing with four dark brown bands, the first three near together on the basal half of the wing, first and third broad, second narrow and oblique in reverse direction; outer line oblique from outer fourth of costa toward anal angle, which it does not reach, but is reflected to discal mark and from there to inner margin at middle; discal mark large, quadrate, filled in with rusty brown; a marginal brown band which sends in a spur to outer line at interspace 5 and 6 and at anal angle. Hind wing with two straight broad brown bands and the margin brown, the edges of these markings a little irregular. Expanse, male, 27 mm.; female, 22 mm.

^a*Arbela* Moore, 1879, is preoccupied by *Arbela* Stål, 1865. Likewise *Hollandia* Karsch, 1896, is preoccupied by *Hollandia* Butler, 1892. Some other name may be available, so I do not propose a substitute at present.

One male, Cuernavaca, Mexico, June, 1909 (R. Müller); two females, Guadalajara and Oaxaca, Mexico (Schaus collection).

Type.—Cat. No. 13046, U.S.N.M.

This species is listed in the *Biologia* as *Samea zinghalis* Walker. This was described from Venezuela, and while I have no specimens from that country, I have a series from Brazil, the Guianas, and the Lesser Antilles, which show a form clearly specifically distinct. The North American *huronalis* Guenée (= *serinalis* Walker) is still another species. The three, *huronalis*, *disparilis*, and *zinghalis* are easily distinguished by the markings of the hind wings.

Genus PACHYZANCLA Meyrick.

PACHYZANCLA JUNCTALIS, new species.

Gray, the wings semitransparent. Fore wing yellowish along the costa, especially at the outer third; lines gray, darker than the wing; inner line narrow, curved, without wavings; two blackish discal dots, orbicular and reniform, with a pale yellow bar between in the cell; outer line curved from costa to vein 2, slightly flexuous, thence inward along vein 2 and thence straight to inner margin at its outer third. Hind wing of the same color as fore wing, the costa and cell pale yellow with a gray mark in the cell; outer line as on the fore wing, curved to vein 2, thence inward and straight to above anal angle. Expanse, 32 mm.

One male, Orizaba, Mexico, January, 1908 (R. Müller).

Type.—Cat. No. 13407, U.S.N.M.

Allied to *Pachyzancla acyptera* Hampson from the same locality, but larger and with the pale patches in the cells of both wings.

CIRAPHORUS, new genus.

Palpi porrect, rather short and with long scales, the third joint nude; fore wing with veins 8 and 9 stalked; hind wing with veins 4 and 5 stalked, separate on fore wing; antennæ with the shaft annulate, longer than fore wing, the legs very long and slender, the wings narrow and pointed; front prominent, smoothly rounded, and without a prominence.

Type of the genus.—*Ciraphorus elcodes* Dyar.

Allied to *Stenoptycha* Zeller and *Lineodes* Guenée.

CIRAPHORUS ELCODES, new species.

Creamy gray. Fore wing cream color at base, brownish beyond the middle, shading to gray at anal angle; an oblique gray band from near middle of inner margin to cell; beyond it a hyaline patch, pointed outwardly and bordered not quite immediately by a black

line; a similar angular mark above it in the end of the cell with a little hyaline marking just beyond the cell; a fine black outer line running close along the curved tip of the costa to a point at apex, thence curved inward and outward again, running below close to outer margin to anal angle; the terminal space thus limited is filled with cream color and marked with black dashes just below the point in the line; a broken black terminal line, edged within by pale. Hind wing hyaline whitish, with the apex smoky gray; a broken terminal black line. Expanse, 27 mm.

One male, Tehuacan, Mexico, September, 1908 (R. Müller); two males, Jalapa, Mexico (Schaus collection).

Type.—Cat. No. 13050, U.S.N.M.

Genus *EROMENE* Hübner.

EROMENE DIATRÆALIS, new species.

Male with the fore wing brown, tinged with ocher, a blackish bar across end of cell interrupted by some whitish scales; small black points indicated at the ends of the veins. Hind wing whitish, shaded with brownish at tip. Expanse, 32 mm.

Female larger, the fore wing largely ocher yellow, a little irrorate with gray, especially along submedian fold. Hind wing pure white. Expanse, 43 mm.

One male, one female, Mexico City, Mexico, May, 1908, and October, 1909 (R. Müller).

Type.—Cat. No. 13051, U.S.N.M.

Proc. N.M. vol. 38—10—18

A NEW AUSTRALIAN CRINOID.

By AUSTIN H. CLARK,

Assistant Curator, Division of Marine Invertebrates, U. S. National Museum.

In the summer of 1887-88 Mr. J. Bracebridge Wilson dredged a number of comatulids in the outer part of the harbor of Port Philip, near Melbourne, Victoria, and outside the Heads, which, on behalf of the Port Philip Biological Survey Committee, were forwarded to the late Dr. P. H. Carpenter for identification. Among them were five specimens which were referred to by Carpenter as "*A. sp. nov.* (prob.)," and he says further on that this form "I believe to be a new species; but it may turn out to be only a strongly marked variety of *A. pumila*." Doctor Carpenter intended to draw up a diagnosis of this crinoid, but he was never able to do it, and no further reference to it appears in the literature.

Thanks to the kindness and generosity of the trustees of the Australian museum at Sydney, New South Wales, and to the curator, Mr. Robert Etheridge, jr., I have recently been enabled to examine the entire magnificent collection of Australian crinoids belonging to that institution. Among the specimens are nearly eight hundred examples of *Compsometra loveni* from various localities and, with them, several of a species which, though allied to it, is quite distinct and shows no evidences of intergradation. This form I take to be the "*Antedon sp. nov.*" referred to by Doctor Carpenter. It may be described as follows:

COMPSOMETRA LACERTOSA, new species.

Antedon sp. nov., P. H. CARPENTER, Proc. Roy. Soc., Victoria, vol. 1, new ser., 1889, p. 135 (Port Philip).

Centrodorsal thin, discoidal, with a broad flat polar area; cirrus sockets in two closely crowded marginal rows.

Cirri XXXIV-XXXVI, 9-12 (usually 10), 7 mm. long, in general resembling those of *Antedon petasus*.

Radials even with the edge of the centrodorsal; IB₁ very short, slightly trapezoidal, about four times as broad as long; IB_r, almost triangular, with the apex produced, about as long as broad. The

IBr series extend out horizontally from the radials so that the arms lie quite flat as in certain comasterids, particularly in the genus *Comatula*.

Ten arms 60 to 65 mm. long, rather stout in the proximal third, but becoming exceedingly slender distally. The distal intersyzygial interval is three oblique muscular articulations.

P₁ 11 mm. long, slender and flagellate, with thirty to thirty-two segments, the first short, the next three or four about as long as broad, the following rapidly becoming elongated, and after three or four more about twice as long as broad, or slightly longer; the second and three following segments have the distal outer edges strongly produced, overlapping, and serrate, but this feature dies away as the segments become longer, so that most of them are smooth; the elongated segments have slightly expanded ends. P₂ 5 mm. long, slightly less stout basally than P₁, with sixteen to twenty segments, of which the second, third, and fourth have their distal outer edges strongly produced; P₃ about 5 mm. long, resembling P₂, but with a stronger production of the distal outer edges of the basal segments, and with this character persistent nearly to the tip of the pinnule, and bearing a large rounded genital gland extending from the third to the twelfth segment. The following pinnules are similar to P₃, but very slightly longer with slightly larger genital glands; after P₁₀ the genital glands gradually decrease in size, disappearing on P₁₆. Distal pinnules exceedingly slender, about 4 mm. long.

Type.—In the collection of the Australian Museum, Sydney, New South Wales.

Cotype.—Cat. No. 24324 U.S.N.M. Both specimens are from Port Jackson, New South Wales.

A REVIEW OF THE FLOUNDERS BELONGING TO THE GENUS *PLEURONICHTHYS*.

By EDWIN CHAPIN STARKS and WILLIAM FRANCIS THOMPSON,
Of Stanford University, California.

In the following paper six American species, and one Asiatic species, of the genus *Pleuronichthys* are described, including two new ones. Types and cotypes of the new species are deposited in the U. S. National Museum.

The distribution of each species is known only so far as specimens at hand indicate, for former records show *Pleuronichthys cænosus* (representing four species) to occur along the entire west coast of the United States.

The species of the *cænosus* group are very well separated geographically, though toward the limits of the area inhabited by each species there is more or less overlapping with areas of neighboring species. Specimens are in the National Museum or in the Stanford University collections, showing the following distribution:

Pleuronichthys nephelus, new species, is known only from Puget Sound.

Pleuronichthys cænosus is found from San Francisco to San Pedro, California. Along the great length of coast between San Francisco and Puget Sound a species of this group occurs, but no records indicate whether it is *Pleuronichthys cænosus* or *Pleuronichthys nephelus*, or whether, as is probable, both are found at some point.

Pleuronichthys ritteri is known from San Pedro southward along nearly the entire west coast of Lower California, or south to latitude 24°. (*Albatross* station 3042.)

Pleuronichthys ocellatus, new species, is known from rather deep water only from near the northern end of the Gulf of California.

Pleuronichthys decurrens is known from San Francisco southward to the Santa Barbara Islands.

Pleuronichthys verticalis is known from San Francisco to the Gulf of California, or along the entire known range of three of the species that have been confused with *Pleuronichthys cænosus*.

Pleuronichthys cornutus is known along the coast of Japan north to Hakodate.

The drawings of the new species accompanying this paper are the work of Mr. W. S. Atkinson.

KEY TO THE SPECIES OF PLEURONICHTHYS.

- a*¹. Origin of dorsal well below level of snout; at least 9 rays on blind side of body.....*decurrens*.
- a*². Origin of dorsal at level of snout, or above; 5 or 6 rays on blind side of body.
- b*¹. Body and fins uniformly covered with brown spots nearly as large as the pupil; no teeth on eyed side of jaws; scales 95 to 108 (Asiatic species)....*cornutus*.
- b*². Body and fins not uniformly covered with brown spots (American species).
- c*¹. Interorbital ridge high and knife-like, ending behind in a sharp spine at least 1 diameter of the pupil above the surrounding level of the head; anterior bony tubercle overhanging mouth; no teeth on eyed side of jaws....*verticalis*.
- c*². Interorbital ridge not so high or sharp as described above; anterior bony tubercle not anterior to mouth; minute teeth on eyed side of mandible.
- d*¹. Scales less than 75 in a series below lateral line; color very dark; broad irregular blotches of dark color with sharp, darker, edges over body and fins; caudal peduncle short and deep with the tips of dorsal and anal rays almost, or quite, reaching bases of caudal rays; posterior interorbital spine very little, or not at all developed.....*nepheus*.
- d*². Scales more than 75; color lighter; caudal peduncle longer; posterior interorbital spine developed.
- e*¹. No bony tubercle developed on anterior end of interorbital ridge....*cynosus*.
- e*². Two bony tubercles developed on anterior end of interorbital ridge.
- f*¹. A spot at about middle of lateral line conspicuously ocellated with milk white; scales from 84 to 91; gill rakers below angle of arch 7 to 9.....*ocellatus*.
- f*². A spot on middle of lateral line often present, but not conspicuously ocellated with white; scales from 79 to 84; gill rakers 9 to 11....*ritteri*.

PLEURONICHTHYS DECURRENS Jordan and Gilbert.

This species may be at once known by the very low origin of the dorsal fin on the blind side of the body, the insertion being below the lower corner of the mouth, and at least nine rays are present on the blind side.

Head contained from $3\frac{1}{2}$ to $3\frac{3}{4}$ in length of body without caudal; depth of body $1\frac{1}{2}$ to 2. Upper orbit, $2\frac{1}{2}$ to 3 in length of head; maxillary 4 to $4\frac{1}{2}$; length of caudal peduncle 4 to $5\frac{1}{2}$; its depth $2\frac{1}{2}$ to 3. Number of dorsal rays 71 to 74; anal rays 46 to 49; scales in series below lateral line 90 to 95; gill rakers 3 or 4 + 7 to 9.

Head considerably thicker than body; the snout projecting beyond the dorsal contour, but less abruptly than in other species, leaving a broad concave area above it extending behind the eyes. The interorbital ridge bears a rather sharp spine at either end; the posterior one the larger; pointing backward and downward. In front of the anterior one, before the lower eye, is a small blunt tubercle, and behind the upper eye are two blunt but very prominent ones. The eyes are large and protruding, and the upper one is posterior to the lower. The dentition is stronger than usual. There are three rows of teeth on the blind side of each jaw; one on the eyed side of the mandible; none on the eyed side of the premaxillary.

The dorsal arises below, or at a level with, the corner of the mouth on the blind side of the head, and about nine rays are off the median line of the body. The ventral of the eyed side is considerably posterior to that of the blind, and the distance between their insertions is contained ten times in the head, or three and one-half times in the upper orbit. The caudal peduncle is longer and more slender than in any other American species in the genus.

The scales are small, not imbricated, and somewhat concealed by the skin, especially on the head. The dorsal branch of the lateral line runs back to about ten rays from the last ray of the dorsal, but the anterior branch is entirely lacking in the specimens at hand.

The color in alcohol is brownish, sometimes mottled with darker, especially at the middle of the lateral line, and posteriorly at the bases of the vertical fins. The vertical fins are brown, sometimes mottled, and narrowly edged with white. The posterior half of the caudal is dark and edged with white across the tips of the rays.

Here described from several specimens from between San Francisco and San Pedro, California, from 8 to 10 inches in length.

Measurements of Pleuronichthys decurrens.

Length of body without caudal, in mm.....	144	155	175	158
Depth of body in hundredths of length.....	50.7	53	50	54
Length of head.....	30	28	30	31
Upper orbit, longitudinal diameter.....	9.8	10	10	11
Distance across both orbits.....	13	14	13	15
Length of maxillary.....	7.3	6.2	6.5	6.2
Ventral of eyed side posterior to that of blind.....	3	3	2.7	3
Length caudal peduncle.....	6	7.5	6	5.5
Depth of caudal peduncle.....	10.5	11.5	10.5	11
Number of dorsal rays.....	72	71	71	74
Anal rays.....	48	46	49	49
Scales, below lateral line, in longitudinal series.....	92	95	90	90
Gill-rakers on first gill arches.....	3+7 (3+7)	4+9 4+9	4+8 4+8	4+8 4+8

PLEURONICHTHYS CORNUTUS Schlegel.

This species is apparently most closely related to *Pleuronichthys verticalis*, having similar dentition; a somewhat similar interorbital ridge and spine (though not nearly so high); and a small number of gill-rakers. It differs from it in the greater number of scales; more numerous rays in the dorsal and anal fins; a smaller upper orbit, and a shorter and more slender caudal peduncle.

Head 4 to 4½ in length of body to base of caudal; depth 1½ to 2. Upper orbit 3 to 3½ in head; maxillary 4 to 4½; length of caudal peduncle 7 to 8; its depth 2. Number of dorsal rays 71 to 75; anal rays 52 to 57; scales in series below lateral line 100 to 108; gill-rakers 3+5 to 7.

The dorsal contour is broken slightly at the eye by the projecting snout as in *Pleuronichthys verticalis*. The interorbital ridge is moderate in height, trenchant and narrow, slightly overhanging the snout,

but not so much so as in *Pleuronichthys verticalis*. On it are two large prominent spines and a bony tubercle as follows: A large sharp spine pointing outward from the anterior end; a small tubercle in front of the lower orbit; and a large sharp spine pointing straight backward from the posterior end. On the posterior margin of the upper orbit are one or two very small tubercles, and a larger one is present on the anterior margin of the upper orbit. The maxillary extends to the anterior margin of the lower pupil, and is hidden anteriorly on the eyed side by the forward extension of the interorbital ridge. At the posterior end of the mandible there is a prominent angle. There are no teeth on the eyed side of either jaw, but bands of minute teeth on the blind side of both. The left nostrils are as near or nearer to the right nostrils than to the dorsal fin.

The dorsal fin begins at the level of the snout, or a little above, and has six rays on the blind side. The ventral of the blind side is anterior to that of the eyed side, and farther from the ventral median edge of the body. The caudal peduncle is somewhat shorter and not so deep as that of *Pleuronichthys verticalis*.

The scales are very small and not imbricated in adults anteriorly. The lateral line has a dorsal branch running back to about the fortieth dorsal ray, but the short anterior branch may be absent or present.

The color in alcohol is a light grayish brown, with small leopard-like dark brown spots scattered rather uniformly and thickly over the body and vertical fins. There are no indications of ocellated spots, or of regularly placed light spots such as are found on most of the American species. Among the specimens at hand are some colored partially or entirely on both sides. These have, in the latter case, more symmetrical pectoral and ventral fins; the upper eye more nearly on the dorsal outline of the body, and the dorsal beginning on a small free lobe overhanging the left margin of the upper orbit.

Here described from numerous specimens from Tsuruga and Aomori, Japan.

Measurements of Pleuronichthys cornutus.

Length of body without caudal, in mm.....	175	95	105	190	145
Depth of body in hundredths of length.....	55	56	50	60	55
Length of head.....	24	25	23	25	24
Longitudinal diameter of upper orbit.....	8	8	8	8	7
Distance across both orbits.....	12	11	13	11	10
Length of maxillary.....	5	6	5.5	6	6
Ventral of eyed side posterior to that of blind.....	2	2	2	2	1.5
Length of caudal peduncle.....	3.5	3	3.5	4	3.5
Depth of caudal peduncle.....	12	12.5	11	13	12
Number of dorsal rays.....	75	75	74	71	75
Anal rays.....	57	56	55	52	54
Scales, below lateral line, in longitudinal series.....	108	105	100	100	100
Gill-rakers on first gill arches.....	3+6	3+6	3+7	3+5	3+6
	3+6	3+6	3+6	3+6	3+6

PLEURONICHTHYS VERTICALIS Jordan and Gilbert.

This species may be known from all others of its genus by its prominent interorbital spines, its greater anterior projection of the interorbital ridge and bony tubercles over the tip of the snout, by its fewer gill-rakers, and from all American species by its having no teeth on the eyed side of either jaw.

Head $3\frac{3}{4}$ to 4 in length of body without caudal; depth, $1\frac{1}{2}$ to $2\frac{1}{4}$. Upper orbit, $2\frac{1}{2}$ to 3 in head; maxillary, 4 to 5; length of caudal peduncle, 5 to 6; its depth, $1\frac{1}{2}$ to 2. Number of dorsal rays, 68 to 71; anal rays, 45 to 48; scales, 88 to 96 in series below lateral line; gill-rakers, 2 or 3 + 6 or 7.

Dorsal outline broken at upper orbit by the projecting snout. The interorbital ridge high and anteriorly is continued so that it overhangs the snout, its anterior edge being almost vertical. On it are two prominent spines; the anterior one between the anterior thirds of the orbit, pointing upward and outward; the posterior on the end of the ridge, larger and sharper than in any other species, and pointing almost straight back. It is above the surface of the head a height equal to 1 diameter of the pupil. On the anterior end of the ridge, in front of the lower eye, is a bony tubercle, and on the posterior margin of the upper eye are three conspicuous blunt ones. A trenchant short ridge forms the anterior edge of the upper orbit and bears a short tubercle just in front of the eye. There are small teeth in bands on the blind side of both jaws, but none on the eyed side of either. The upper eye is considerably posterior to the lower, and the orbits are somewhat larger than in other species. The maxillary is concealed by the overhanging bony tubercle for the greater part of its length.

The dorsal fin arises on a level with the snout, and has five or six rays on the blind side. The insertion of the ventral on the eyed side is posterior to that on the blind a fourth or a fifth of the diameter of the upper orbit. The caudal peduncle is rather long; measuring from the base of the last anal ray to that of the lower caudal ray its length is contained five or six times in the head.

The scales are small, and are scarcely imbricated, especially toward the sides of the body. The dorsal branch of the lateral line extends back to under the middle of the dorsal, but the anterior branch is usually lacking in the adult.

The color in alcohol is uniform light brown with blotches of darker faintly shown near the middle of the lateral line, and at the base of the caudal peduncle. The vertical fins are mottled with large brown spots.

Here described from five specimens from San Francisco and from southern California, from 6 to 9 inches in length.

Measurements of Pleuronichthys verticalis.

Length of body without caudal, in mm.....	119	115	62	220	220
Depth of body in hundredths of length.....	48.5	52	48	57	54
Length of head.....	26	27	25	25	25
Longitudinal diameter of upper orbit.....	9.5	9.5	10	9	9
Distance across both orbits.....	10	9	11	10	10
Length of maxillary.....	6.2	5.5	6	5.5	5.5
Ventral of eyed side posterior to that of blind.....	4.2	4.2	2.5	2	2
Length of caudal peduncle.....	4.2	4.5	5	5	5
Depth of caudal peduncle.....	13.5	13.5	13	14	14
Number of dorsal rays.....	71	70	68	69	70
Anal rays.....	45	48	48	48	48
Scales, below lateral line, in longitudinal series.....	95	88	88	96	96
Gill-rakers on first gill arches.....	$\left\{ \begin{array}{l} 2+6 \\ 3+7 \end{array} \right.$	$\left\{ \begin{array}{l} 3+7 \\ 2+7 \end{array} \right.$	$\left\{ \begin{array}{l} 3+6 \\ 3+6 \end{array} \right.$	$\left\{ \begin{array}{l} 3+6 \\ 3+6 \end{array} \right.$	$\left\{ \begin{array}{l} 3+6 \\ 3+6 \end{array} \right.$

PLEURONICHTHYS NEPHELUS Starks and Thompson, new species.

This species has a fewer number of scales than any other of the genus; its low interorbital ridge is free from spines; and the ventral of its eyed side is not so far posterior to its fellow of the opposite side. From *Pleuronichthys canosus* it may be known in addition by the smaller diameter of the upper orbit.

Head from $3\frac{1}{2}$ to $4\frac{1}{2}$ in length of body without caudal; depth $1\frac{1}{4}$ to 2. Upper orbit 3 to $3\frac{1}{2}$ in head; maxillary $3\frac{1}{2}$ to 4; length of caudal peduncle measured to marginal caudal rays 7 or 8; its depth $1\frac{1}{2}$ to 2. Number of dorsal rays 66 to 75; anal rays 47 to 56; scales in series below lateral line 66 to 75; gill-rakers 3 or 4 + 9 to 11 (in one specimen 12).

Body very symmetrical in dorsal and ventral contours, which are evenly curved from caudal to tip of snout. The interorbital ridge is low and without prominent spines; at the anterior end are sometimes very slight indications of tubercles, and the position of the posterior spine is marked by little more than a slight angle, except in the type (the largest specimen) there is a blunt tubercle. The eyes are small, not very prominent, and nearly opposite to each other. The nostrils of the left side are close to the dorsal, and those of the right are not so far removed from those of the left as usual. The maxillary is not covered by the preorbital bones. There is a row of teeth on the eyed side of the mandible, but none on the premaxillary of that side, and three or four rows on the blind side of each jaw.

The dorsal fin arises a little above the level of the tip of the snout. The dorsal and anal extend so close to the base of the caudal that the tips of their last rays nearly or quite reach to the bases of the marginal caudal rays. The ventrals are more nearly opposite to each other in insertion than in other species of the genus; the distance of that of the eyed side behind that of its fellow of the opposite side is contained three or four times in the length of the maxillary. The caudal fin is very conspicuously broad and round in outline.

The scales are large and unimbricated over the entire body, sometimes much buried in the skin, the lateral line ascending less than usually anteriorly, with a short anterior branch, and a long posterior one ending under the middle of the dorsal.

The color in alcohol is dark olive mottled with irregular darker blotches sharply cut and darker toward their edges. A black spot, as large as the eye, indistinctly ocellated is present on the middle of the lateral line. On the caudal is a larger, round, dusky spot; a dark bar across the base of the rays, and the balance of the fin mottled and edged with white behind. The vertical fins are irregularly mottled and very narrowly edged with white.

Here described from twelve specimens from Puget Sound, Washington. The type is 10½ inches in length, and was collected among the San Juan Islands near the northern end of the sound. It is deposited in the U. S. National Museum. The cotypes are from 6 to

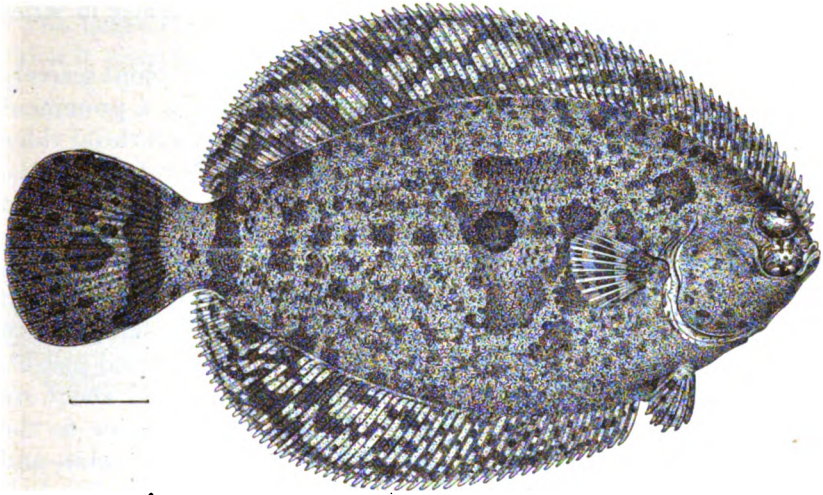


FIG. 1.—PLEURONICHTHYS NEPHELUS.

9 inches in length, and except two, which are from near Seattle, are from the same locality. They are deposited among the collections of Stanford University.

Measurements of Pleuronichthys nephelus.

Body length without caudal, in mm.	188	155	133	125	171	160	163	141	130	215	109	124
Body depth in hundredths of length	55.5	51	52	50	52	52	49	52	50	49	51.5	52
Length of head	23	24	24	26	24	23	24	22	24	25	25.5	27.2
Longitudinal diameter of upper orbit	7.4	8.1	8.3	7	7.3	8	8	7.5	8	7.5	8.1	9.1
Distance across both orbits	10	11	12	11	10	10	10	11	11	10	10	12
Length of maxillary	6.5	6.5	6.5	7	6	7	6	6	6.5	6.5	6.5	7.2
Ventral of eyed side posterior to that of blind	2	1.5	1.5	1.5	1.5	2	1.5	1.5	1.2	1.5	2	1.5
Length of caudal peduncle	3.5	3.5	3.5	2	3	2.5	3.5	2.5	3	3.5	2	3
Depth of caudal peduncle	14	13	13.5	13.5	13	14	13	15	13	13.5	13	14
Number of dorsal rays	72	68	69	70	68	66	72	68	69	75	67	70
Number of anal rays	50	49	47	49	47	47	49	48	50	56	51	49
Scales below lateral line in longitudinal series	75	71	68	75	73	69	75	70	65	70	72	75
Gill-rakers	3+10 3+9	3+10 3+9	3+10 3+10	3+10 3+8	3+10 3+10	3+9 3+9	3+9 3+9	3+10 3+11	3+10 3+10	3+11 3+11	4+9 4+9	4+12 4+11

PLEURONICHTHYS CENOSUS Girard.

This species differs from *Pleuronichthys ritteri* in having no bony tubercle on the anterior end of the interorbital ridge; a greater number of dorsal and anal rays; a greater number of scales; a shorter distance across both orbits; a shorter caudal peduncle; a lower, more symmetrical, dorsal, and ventral outline of body; a less abruptly protruding snout; and (in the specimens at hand) in having the usual spot at the middle of the lateral line absent.

Head 3 to 4 in length of body without caudal; depth 2. Long diameter of upper orbit $2\frac{3}{4}$ to $3\frac{1}{4}$ in head; maxillary 4; length of caudal peduncle to base of lower caudal rays 8 to $8\frac{1}{2}$; its depth 2. Number of dorsal rays 70 to 74; anal rays 50 to 53; scales in series below lateral line 80 to 91; gill-rakers $4+10$ or 11.

Body oval in outline, the curve symmetrical with the snout scarcely projecting as it does in *Pleuronichthys ritteri*. There is a prominent angle at the posterior end of the mandible. The interorbital ridge is rather high and without spines save for a rather blunt one at the posterior end pointing backward and somewhat downward. Behind the upper eye is a small blunt tubercle not very prominent. The nostrils of opposite sides are three times as far apart as from the dorsal fin. There are three or four rows of teeth on the blind side of each jaw, and one row on the eyed side of the mandible, but no teeth on the eyed side of the premaxillary. The dorsal is inserted just at, or a little above, the level of the point of the snout, and about six rays are on the blind side. The right ventral is posterior to the left a fourth or a fifth of the long diameter of the upper orbit, and nearer to the ventral ridge than its fellow. The caudal peduncle is short and deep; measured to the marginal caudal rays its length is contained eight times in the head.

The scales are small, nowhere closely imbricated, but much less so in large individuals than in small ones, especially along the outer margins of the body. The lateral line has a short branch running anteriorly, and a longer one running posteriorly along the base of the dorsal fin to opposite its middle.

Color in alcohol dark brown with mottled, blended spots, slightly darker in color, especially at the middle of the lateral line, at the base of the caudal, and at the bases of the vertical fins posteriorly. A slightly dusky blotch is present on the caudal fin. The blended dusky blotch at the middle of the lateral line is not conspicuous as in *Pleuronichthys ritteri*.

Here described from specimens from San Francisco and San Pedro, California, from 8 to $13\frac{1}{2}$ inches in length

Measurements of *Pleuronichthys caenosus*.

Length of body without caudal, in mm.....	166	250	265
Depth of body in hundredths of length.....	53	52	53
Length of head.....	25	28	26
Upper orbit (longitudinal diameter).....	9.5	8.5	8.5
Distance across both orbits.....	9	11	11
Length of maxillary.....	6.5	6.5	7
Ventral of eyed side posterior to that of blind.....	2	2.5	2.3
Length of caudal peduncle.....	3	3.5	4.5
Depth of caudal peduncle.....	13	13	14
Number of dorsal rays.....	74	70	78
Number of anal rays.....	53	50	53
Scales in longitudinal series below lateral line.....	91	91	80
Gill-rakers on first gill-arches.....	{ 4+10 4+11	{ 4+10 4+11	{ 3+9 4+8

PLEURONICHTHYS OCELLATUS Starks and Thompson, new species.

The nearest relative of this species is *Pleuronichthys ritteri*, from which it may be known by the presence of a very conspicuous spot

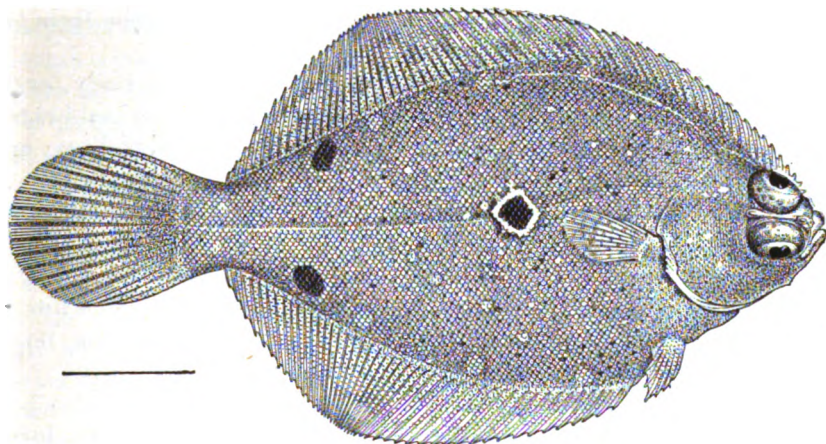


FIG. 2.—PLEURONICHTHYS OCELLATUS.

ocellated with milk white midway on the lateral line between the base of the caudal and the snout; by its fewer number of gill-rakers; its greater number of scales; the greater long diameter of its upper orbit, and its interorbital spine a little higher, sharper, and less inclined to bend downward.

Head from $3\frac{3}{4}$ to $4\frac{1}{4}$ in length of body without caudal; depth 2 to $2\frac{1}{4}$. Long diameter of upper orbit 2 to $2\frac{1}{8}$ in head; distance across both orbits two in head; length of maxillary $3\frac{1}{2}$ to 4; length of caudal peduncle, measured to marginal caudal rays, from 6 to $7\frac{1}{2}$; its depth two. Number of dorsal rays from 61 to 72; anal rays 44 to 50; scales in series below lateral line from 84 to 91; gill-rakers 3 or $4+7$ to 9.

The dorsal contour of body outlines broken conspicuously at the upper orbit by the projecting snout. The interorbital ridge is trenchant, narrow, and rather low. The spine on its posterior part

is rather low, and points straight backward. On its anterior end, close together, are two tubercles above the front of the lower eye; on the posterior margin of the upper orbit are two blunter, less conspicuous ones; a very small one is on the anterior margin of the upper eye. The eyes are large and protruding, and the upper one is posterior to the lower. The left nostrils are remote from the base of the dorsal fin, but nearer to it than to the right nostrils. The maxillary reaches nearly to the anterior margin of the pupil. There is one row of very minute teeth on the eyed side of the lower jaw, and closely set, small bands on the blind side of both jaws, but none on the premaxillary of the eyed side.

The dorsal fin springs from, or slightly above, the level of the tip of the snout, with five or six rays on the blind side. The anal and dorsal are equal in height, the longest ray is contained seven times in the length of the body. The ventral of the eyed side is much posterior to that of the blind, and at a considerable distance from the ventral body ridge.

The scales are small and imbricated over the whole body, or at least in contact with each other. The lateral line has a dorsal branch running back from the head to about the thirty-fifth dorsal ray, and a short anterior branch is usually present.

The color in alcohol is uniform light brown on the eyed side, with a very prominent dark brown spot ocellated with milk white at the middle of the lateral line. A very inconspicuous, similar spot is at the base of the dorsal and anal fins posteriorly. Spots of white of irregular size, but very indefinite, are scattered over the body, especially along the bases of the vertical fins.

Here described from nine specimens from *Albatross* stations 3027 and 3024, in the Gulf of California. The type is from the latter station, and is 6 inches in length. It is deposited in the U. S. National Museum. Cotypes from the same locality in the National Museum have been examined (16 specimens examined altogether). Other cotypes are deposited in the collections of Stanford University.

Measurements of Pleuronichthys ocellatus.

Length in mm. of body without caudal.....	100	124	103	115	110	96	103
Depth of body in hundredths of body length.....	49.5	52	51	52	52	50	49.5
Length of head.....	25	26.5	24.5	27	25.5	24	24
Longitudinal diameter of upper orbit.....	10	9	10	11	10	11	10
Distance across both orbits.....	12	13	11.5	12.5	12	11	11.5
Length of maxillary.....	6	7	7	7	7	7	5.5
Ventral of eyed side posterior to that of blind.....	2.5	2.5	2.5	3	2	2	2.5
Length of caudal peduncle.....	4.5	4	3.5	5.5	3	3	4
Depth of caudal peduncle.....	12	14	13.5	13	13.5	13.5	12
Number of dorsal rays.....	67	66	69	61	71	66	62
Anal rays.....	46	47	48	44	50	46	50
Scales in longitudinal series below lateral line.....	90	89	89	84	90	85	91
Gill-rakers on first gill-arches.....	3+7	3+7	4+8	4+8	3+7	4+8	3+9
	4+8	4+7	4+8	4+8	4+8	3+8	4+9

PLEURONICHTHYS RITTERI Starks and Morris.

This species is more nearly related to *Pleuronichthys ocellatus* than to any other, and may be distinguished as indicated under the description of that species.

Head 4 to $4\frac{1}{2}$ in length of body to base of caudal; depth $1\frac{1}{2}$ to 2. Upper orbit $2\frac{3}{4}$ to 3 in head; maxillary 4; length of caudal peduncle from $3\frac{1}{2}$ to $4\frac{1}{2}$, its depth from 2 to $2\frac{1}{4}$. Number of dorsal rays from 61 to 68; anal rays 45 to 46; scales in series below lateral line, 79 to 84; gill-rakers, 4 to 6 + 10 to 11.

Body more strongly curved than in *Pleuronichthys caenosus*, the dorsal curve broken at the middle of the upper eye by the projecting snout, though less so than in *Pleuronichthys ocellatus*. The inter-orbital ridge is lower than in *Pleuronichthys caenosus*, with two tubercles at the anterior end, and a low conical spine on the posterior end pointing posteriorly and slightly downward. On the posterior margin of the upper orbit are two small tubercles, and on its anterior margin a smaller one. The upper jaw has no teeth on the eyed side. There are three or four rows on the blind side of each jaw, and one row on the eyed side of the mandible. The nostrils of the blind side are closer to the base of the dorsal fin than in *Pleuronichthys ocellatus*.

The dorsal fin arises on, or a very little below, the level of the tip of the snout. The ventral of the eyed side is inserted posterior to that of the blind side a distance equal to one-half of the length of the maxillary.

The scales are imbricated except opposite the middle of the dorsal and anal fins, where they are usually separated and somewhat embedded. The lateral line has a short anterior branch, and a dorsal branch running posteriorly to under the middle dorsal rays.

The color in alcohol is dark brown with a small dark spot the size of the pupil, or a little larger, slightly posterior to or at the middle of the body, and two larger, more distinct spots opposite to the posterior fifth of the dorsal and anal fins at the base of the rays.

Here described from six specimens from San Diego (the type and cotypes) from $4\frac{1}{2}$ to 10 inches in length.^a

Measurements of Pleuronichthys ritteri.

Length of body without caudal, in mm.....	124	83	192	158	85	127
Depth of body in hundredths of length.....	56	54	54	50	51	52.7
Length of head.....	23	24.5	22.5	23	25	26
Longitudinal diameter of upper orbit.....	8	9	7.5	8	9	8.6
Distance across both orbits.....	10	9.5	9.5	9	9.5	9
Length of maxillary.....	6	6	5	6	6	6.3
Ventral of eyed side posterior to that of blind.....	3	2.5	3	3	3	3
Length of caudal peduncle to marginal caudal rays.....	4	4	6	5	5	5
Depth caudal peduncle.....	14	13	13	11	11	12
Number of dorsal rays.....	68	67	63	61	61	68
Number of anal rays.....	46	46	45	45	46	45
Scales in longitudinal series below lateral line.....	79	81	83	79	79	84
Gill-rakers.....	$4+10$	$4+10$	$4+10$	$4+10$	$5+11$	$5+11$
	$4+11$	$4+10$	$4+10$	$3+9$	$6+11$	$6+11$

^aOriginal described in University of California Publications, vol. 3, 1907, p. 243, Contr. to Lab. of Marine Biological Association of San Diego, XVI.

THE NORTH AMERICAN BEES OF THE GENUS *NOMIA*.

By T. D. A. COCKERELL,
Of the University of Colorado, Boulder.

For many years past the National Museum has possessed a series of undescribed species of the genus *Nomia*, to which Dr. W. H. Ashmead gave manuscript names. In the new catalogue of bees now in preparation I was anxious to cite these names, but as their esteemed author unhappily never found time to prepare descriptions, I asked for the loan of the material in order to publish the necessary diagnoses. While giving these, I have thought it useful to arrange the species into groups and cite all those belonging to our fauna.

At the outset the question arises as to the number of genera to be recognized. Doctor Ashmead, in 1899, divided the *Nomia* of authors into *Epinomia* Ashmead, *Nomia* Latreille, *Paranomia* Friese, and *Monia* Westwood (*Eunomia* Cresson). *Monia*, however, is really a Colletid, and since *Eunomia* is preoccupied it takes the name *Dieunomia* Cockerell.^a Other segregates are the African *Crocisaspidia* Ashmead and *Stictonomia* Cameron, and the Asiatic *Hoplonomia* Ashmead (type *H. quadrifasciata* Ashmead).

The common usage in the United States has been to recognize two genera, *Nomia* and *Eunomia* (*Dieunomia*). It is not quite clear whether *Nomia* can be usefully split up into a number of genera, but at present it seems better to regard all the American forms as pertaining to a single genus with several named subgenera. The type of *Nomia* is the European *N. diversipes* Latreille, of which I have specimens from Doctor Friese. This is a strongly punctured insect, with very large tegulae and curious laminate tubercles. It represents a subgeneric group (*Nomia*, s. str.) not found in America. *N. ruficornis* Spinola belongs to the same subgenus, which is also characterized by a backwardly-directed tooth at each side of the scutellum in the male. *N. ruficornis* has what at first sight seem to be white tegumentary bands on the abdomen, but they are really bands of dense

^a Entomologist, vol. 32, p. 14.

white hair at the bases of the segments, more or less covered by the hyaline apices of the segments before.

Paranomia Friese (type, *chalybeata* Smith, from China) includes the species with colored pearly bands on the abdomen, represented in America by the group of *N. nortoni*. *Hoplonomia* Ashmead is similar, but has a bidentate process or two teeth on the postscutellum.

Epinomia Ashmead (type, *triangulifera* Vachal) should probably be extended to include the group of *N. nevadensis*. This is the most "normal" of our groups of *Nomia*, in the sense of being less divergent from other bees.

Dieunomia (type, *marginipennis* Cresson) consists of large species, in which the last antennal joint is broadened and flattened. *N. boliana*, a smaller species just described, must also be referred here.

It would not be illogical to exclude *Nomia* from the American fauna, and recognize three genera, *Paranomia*, *Epinomia*, and *Dieunomia*; but in this case it would be necessary to decide what to do with the numerous African, Asiatic, and Australian species, which in various ways seem to connect the segregated genera with true *Nomia*, or in some cases form what might be regarded as other genera or subgenera. I have a considerable series of these foreign insects and am at a loss to know how to satisfactorily divide them into genera. The group is a peculiar one, and apparently its little morphological jokes must not be taken too seriously.

Perhaps the most significant distinctions are to be found in the mouth parts. In the type of the genus, *Nomia diversipes*, I find the tongue short, broad at the base, rapidly narrowing to a linear tip. The labial palpi have the first joint much shorter than the other three combined (proportions about 13 to 20), and the maxillary palpi extend beyond the maxillary blade, which is very bristly at the end. In *Nomia nevadensis* the conditions are essentially the same, but the first joint of the labial palpus is to the others combined as about 13 to 18, the apical joint being shorter. In *N. foxii* the first joint of the labial palpus is to the other three combined as about 20 to 22, approaching equality, while the tongue is considerably elongated, gradually tapering, its length about 1,275 μ , its width at base about 220, not counting the hair.

The following figures give the lengths of the joints of the labial palpi in microns. For the first joint only the dark chitinized part is measured.

Labial palpi, joints.....	(1)	(2)	(3)	(4)
<i>Nomia triangulifera</i>	510	220	204	220
<i>Nomia nevadensis</i>	220	100	100	100
<i>Nomia diversipes</i>	220	100	110	136
<i>Nomia foxii</i>	340	127	127	127

In typical *Epinomia* (*triangulifera*) the tongue is short. In *Dieunomia* it is dagger-shaped. In *Paranomia* it is elongated. In *Hoplonomia*, which is really a section of *Paranomia*, it is long and slender, as I find on examining a specimen of *N. elliottii* Smith, from India. I also find a linear tongue in some Australian species, as *N. semiaurea* Cockerell and *N. gilberti* Cockerell, the latter having it remarkably long and slender.

The tongue and mouth parts of *Nomia diversipes* are typically Halictine in character, and compared with those of *Agapostemon melliventris* Cresson, they show no important difference. The large hyaline inner lobe of the maxillary blade is quite the same, and this is especially noteworthy because *Andrena* shows an entirely different structure, with no hyaline lobe. *Nomia* can not go in the Andreninæ, but must be considered to typify a subfamily Nomiinæ, closely related to the Halictinæ.

The following notes compare Halictine with Nomiine bees:

Agapostemon melliventris Cresson. A specimen compared with *Nomia diversipes* showed a difference in the paraglossæ, which hardly exceeded the apex of second joint of labial palpi, while in *N. diversipes* they reached the level of base of last joint. The *Agapostemon* was a male, and on examining a female of the same species, it was found that the paraglossæ nearly reached the tip of the labial palpi. In *Agapostemon radiatus* Say the paraglossæ were found to reach about the level of the end of the labial palpi. The tongue and labial palpi are longer in this species than in *A. melliventris*.

Sphecodogastra texana (Cresson) has the tongue as in *Nomia diversipes*, and the broad paraglossæ reach the middle of the last joint of labial palpi. The maxillary palpi are much larger and longer than in *N. diversipes*.

Halictus sisymbrii Cockerell differs from *Nomia diversipes* by the much broader and shorter tongue, with the linear apical part very much shorter.

Halictus armaticeps Cresson has the tongue a little more slender than in *Nomia diversipes*, but it tapers much more gradually to the linear apical process, which is also shorter.

It is evident that the Halictines and Nomiines have independently produced groups with linear tongues. There are two such groups among the Halictines which I consider to have generic value, namely, *Augochlora* in America, and *Thrinchostoma* in Africa. It may be asked why, if I consider these valid genera, I do not also accept *Paranomia* as a genus on the same grounds. It is because I have never seen a species of *Augochlora* or *Thrinchostoma*, which could not be readily recognized as such, while I do not know how to divide *Nomia* into similarly recognizable groups. This, however, may

merely be due to insufficient acquaintance with the numerous Asiatic and African species.

In connection with the evident relationship of the Nomiines to the Halictines, it is interesting to note that some of the latter have ivory-colored or yellowish tegumentary abdominal bands; such are *Halictus vittatus* Smith from South Africa and *H. flavovittatus* W. F. Kirby from Socotra.

Nomia is doubtless of Old World origin, probably reaching America in later miocene times. Two species, *N. jenseni* Friese and *N. jørgenseni* Friese, have recently been described from Argentina, but Vachal points out that they have colletid mouth parts, and refers them to his genus *Lonchopria*. They are very beautiful insects, with light tegumentary abdominal bands in the manner of *Paranomia*, but the male antennæ are short, and neither the metathorax nor the venter of the abdomen are constructed as in *Nomia*.

GROUP OF NOMIA NEVADENSIS.

Rather small species, the abdomen without iridescent bands; male with the hind tibia broad, its inner edge with the apical half broadly excavated; tegulæ and tubercles not enlarged.

(A) Abdomen wholly or largely bright ferruginous.

Nomia nevadensis Cresson. Described from Nevada, and ranges through Arizona into New Mexico, where it is common in the middle Sonoran zone at flowers of various compositæ, as *Bahia dissecta*, *Leucosyris spinosa* and *Isocoma wrightii*.

(B) Abdomen dark.

Nomia bakeri Cockerell. Found in Colorado, at Denver and Boulder. Mrs. Bennett has collected it at flowers of *Solidago*.

NOMIA PATTONI, new species.

Nomia pattoni ASHMEAD MS. (No description.)

Closely related to *N. bakeri*, but smaller (size of *N. arizonensis*), the female with the femora red, as well as the tibiæ and tarsi, the antennæ also red. In the male, the face is narrower below; the hind legs, though paler, do not differ in structure, and the male antennæ are practically the same in both. There are no tangible differences in sculpture. The length of the anterior wing is a rather scant 8 mm. At first sight, *N. pattoni* looks like *N. arizonensis*, but it agrees with *bakeri* and differs from *arizonensis* in the character of the basal area of metathorax, which is rather large, and more or less boat-shaped, instead of narrowly crescentic. *N. pattoni* is also readily known from *arizonensis* by the color of the legs, the more densely punctured mesothorax, and the absence of an evident subbasal constriction on the second abdominal segment of the female. It may perhaps prove to

be a subspecies of *N. bakeri*, but in any event it will be easily distinguished in its typical range.

Habitat.—Utica, Mississippi (type-locality), from Ashmead's collection; Selma, Alabama, October, 1880, and July, 1881 (W. H. Patton, collector.)

Type-specimen.—Cat. No. 12984, U.S.N.M.

A female from Selma, Alabama, is labeled "Sept. 30, 1880. E. A. Schwarz.. See notes on *Myodites*."

Named for W. H. Patton.

***NOMIA ARIZONENSIS* Cockerell.**

The U. S. National Museum has a long series from Arizona, the precise locality, whenever given, being Tucson. In the male the wings, except for the broad dark apical border, are very pale, almost milky; but in the females they are more yellowish or dusky. The females have collected a great quantity of orange pollen, no doubt from the compositæ. In the male, the median depression or constriction of the first three abdominal segments is extremely marked, and the flagellum is ferruginous beneath, this color abruptly contrasting with the black which occupies two-thirds of the circumference.

***NOMIA ARIZONENSIS ANGELESIA*, new subspecies.**

Nomia angelesia ASHMEAD MS. (No description.)

I was first inclined to treat this as identical with *N. arizonensis*, but it is normally larger (anterior wing, $8\frac{1}{2}$ mm.). The mesothorax seems less densely punctured, and the male flagellum is quite differently colored, being very dark reddish beneath, the red shading into the black. The basal area of the metathorax is very narrow (i. e., short antero posteriorly). The tegulæ are clear fulvotestaceous, and the light abdominal hair-bands are very distinct.

Habitat.—Los Angeles County, California (D. W. Coquillett)—type-locality; San Bernardino County, California, "338, through C. V. Riley."

Type-specimen.—Cat. No. 12985, U.S.N.M.

GROUP OF *NOMIA* TRIANGULIFERA (EPINOMIA).

Larger than the species of the *nevadensis* group; abdomen black, without iridescent bands; hind tibiæ of male much broadened apically, produced at the inner apical corner into a large stout spine, but the inner side only slightly concave beyond the middle, not excavated. The triangular depression on the fourth ventral segment of the male is also well marked in the *nevadensis* group, becoming narrower, however, in *N. arizonensis angelesia*. The females resemble species of *Andrena*, and may be found visiting species of Compositæ.

The apical joint of the male antennæ is not dilated in the *triangulifera* or *nevadensis* group. The inclosure of the metathorax in *N. triangulifera* is boat-shaped, more or less narrowed in the middle. The tegulæ in the female are variably infuscated, whereas in all members of the *nevadensis* group they are pellucid rufotestaceous.

The only species of this group is *Nomia triangulifera* Vachal, 1897 (*persimilis* Cockerell 1898), found in Nebraska, Kansas, and New Mexico. It is the type of Ashmead's genus *Epinomia*.

GROUP OF NOMIA HETEROPODA (DIEUNOMIA).

Very large species; abdomen black, without iridescent bands; males with apical joint of antennæ swollen, and middle femora greatly swollen, the hind legs also much modified, the hind basitarsus extremely long.

(A) Wings uniformly dark fuliginous.

Nomia heteropoda Say. A female from Victoria, Texas, at flowers of *Helianthus*, October 2, 1904 (J. C. Crawford, collector), is referred here.

(B) Wings hyaline, orange-tinted, with the apical margin very broadly fuliginous.

Nomia apacha Cresson. I refer here two females from Victoria, Texas, at flowers of *Helianthus*, October 2, 1904 (A. J. Leister, collector). I am at some disadvantage with regard to this and the last species from having only females (the male of *apacha* is unknown), and from not having authentic material for comparison; I have seen the species, however, in the Cresson collection, and the present specimens accord very well with my notes and recollections. The *apacha* and *heteropoda* were taken at the same place, on the same day, at *Helianthus*, and appear to be identical except for the very different coloration of the wings. Is it possible that they are two forms of a single species?

N. apacha is known to be western (Colorado, New Mexico), while *N. heteropoda* is eastern (Texas to Arkansas and Maryland); do they meet at Victoria, Texas, and possibly hybridize? There is apparently a problem here calling for field investigations.

From the other species with similarly colored wings, *N. apacha* is readily known by the combination of strongly fulvous pubescence on the thorax above with light fulvous tegulæ and a very black, unbanded, abdomen.

N. marginipennis Cresson. A female before me is from Rocky Ford, Colorado, collected by Prof. C. P. Gillette.

Nomia xerophila Cockerell. Mesilla Park and Aztec, New Mexico; Sterling, Colorado (S. A. Johnson, collector); Moab Utah, "S. 10, '06" (U. S. National Museum). In the male, it is the fourth ventral segment which is elevated at the lower lateral corners, and the fifth which

bears nodules, not the third and fourth, respectively, as stated in the original description.^a In this species, the hair of the thorax above is pale yellowish-gray, unlike the fulvous of *apacha* or the seal-brown of *marginipennis*; the tegulæ are darker than in *apacha*, but not so dark as in *marginipennis*.

GROUP OF *NOMIA MESILLÆ*.

Known only from a single male, the type of *N. mesillæ* (Cockerell). It is similar in most respects to the males of the *heteropoda* group, but the middle femora are less modified, the middle tibiæ have no spurs, and there are other differences. The abdominal hair-bands are very distinct. The insect was taken by Mr. C. M. Barber at Mesilla, New Mexico.

GROUP OF *NOMIA BOLLIANA*.

The only species known is *N. bolliana* Cockerell, 1910, from Texas. The female looks at first sight just like *N. triangulifera*, agreeing in size, build, color, and manner of collecting pollen. Upon close comparison many differences are apparent, such as the narrowly crescentic area of metathorax, the more sparsely punctured first abdominal segment, and the pellucid rufo-fulvous tegulæ, which are quite elongate, sinuate on the outer margin, in the manner of the *heteropoda* group. The tibiæ and tarsi are ferruginous. The wings are colored as in *N. apacha*. The male is very different from that of *N. triangulifera*, the following characters being distinctive: Antennæ long, black, the flagellum crenulated, with the apical joint flattened and broadened, as in the *heteropoda* group; face broad, densely covered with yellowish-white hair; tongue narrow apically, broadened basally, very hairy; vertex and thorax above with very pale yellowish hair, colored as in *N. zerophila*; area of metathorax strongly plicate; abdomen densely punctured, first three segments constricted; fourth ventral segment with median depression parallel-sided, not at all triangular (but it may broaden under the margin of third), and its lateral angles not elevated; fifth ventral with a pair of nodules; femora black, except knees, tibiæ and tarsi; ferruginous; middle femora very little swollen, inclined to be keeled beneath; middle tibiæ and tarsi ordinary, the tibial spur present; hind trochanters produced to a large obtuse tooth, and with a little basal process on outer side; hind femora much swollen, very convex above; hind tibiæ broadly triangular, the lamina produced to a prominent submedian angle, and with also an apical process; hind basitarsus not excessively long.

This species was described from a single female in the Berlin Museum. The U. S. National Museum contains both sexes, from

^a Entomologist, Nov. 1899, p. 266.

Denton and Wichita Falls, Texas. The Wichita Falls (female) specimen is from flowers of *Helianthus*, June 10, 1906 (J. D. Mitchell, collector). The Denton (both sexes) specimens are from flowers of *Rudbeckia amplexicaulis*, June 29 (F. C. Bishopp, collector).

The produced hind trochanters of the male occur also in all members of the *nevadensis* group.

GROUP OF *NOMIA NORTONI*. (PARANOMIA.)

Hind margins of abdominal segments iridescent green or blue; tongue slender; apex of male antennæ neither flattened nor dilated.

(A) Male antennæ long, with the last joint elongated and sharply pointed.

Nomia nortoni Cresson. Kansas, Texas, and New Mexico. *N. cressoni* Westwood, from Mexico, is the same. I have a Mexican specimen. This species is much the largest of the group; anterior wing about 13 mm.

N. melanderi Cockerell. Known only by a single female from Washington State. It is not certain, in the absence of the male, that this belongs in the subgroup with pointed antennæ, but I believe it is correctly so referred.

NOMIA CALIFORNICA, new species.

Nomia californica ASHMEAD MS. (No description.)

Female.—Size and form of *N. melanderi*, from which it differs as follows: Abdominal bands light yellowish-green, with a variable amount of orange suffusion; first segment with an entire narrow apical band; stigma redder. Thus, while the differences are technically very slight, the insect looks quite distinct. There is a good deal of short black hair on the thorax above, and the tegulæ are reddish black.

Habitat.—Southern California, "No. 331, through C. V. Riley;" Los Angeles County, California (D. W. Coquillett, collector).

Type-specimen.—Cat. No. 12986, U.S.N.M.

NOMIA ACUS, new species.

Male.—Anterior wing a fraction over 9 mm. Male flagellum long, pale yellowish-fulvous beneath, the last joint long and pointed as in *N. nortoni*; thorax above very strongly punctured, and with grayish-white hair, scutellum slightly bigibbous; abdomen narrow basally, the first two segments very coarsely punctured, the others finely; first segment with hind margin wholly dark; segments 2 to 5 with broad light bluish-green bands; structure of legs as in *N. nortoni*, the hind femora greatly swollen, and the hind tibiæ with a very large quadrangular pale honey-colored lobe; tarsi fuscous; fourth ventral abdominal segment divided into two plates as in *N. nortoni*. This

is at once distinguished from *N. melanderi* and *californica* by the strong relatively much denser puncturation of disk of mesothorax, scutellum, and first abdominal segment; but in *Nomia* this may be only a sexual character. In the color of the bands this agrees with *N. melanderi*, but the tegulæ are hyaline with a fulvous spot, whereas in *melanderi* they are opaque black. From the locality, one would associate it with *N. californica*, but the color of the bands is quite different, and the first segment has no light band. The wings are yellower than in *melanderi* or *californica*, and the apical margin is paler. The face is rather narrow, and the orbits converge below. The clypeus is shining and somewhat concave.

Habitat.—Southern California, "through C. V. Riley."

Type-specimen.—Cat. No. 12987, U.S.N.M.

(B) Male antennæ elongate, slender apically, but the point obtuse. Species of the West Indies.

Nomia robinsoni Cresson. Cuba.

N. wickhamii Ashmead. Eleuthera, Bahamas. The type is before me, collected by Henry Ditzen. It is evidently very close to *N. robinsoni*, but easily distinguished by the much greater amount of black on the tibiæ. From Ashmead's description, I had difficulty in separating this from *N. foxii*, but it is really quite distinct, differing as follows: Hair of face yellowish; scape much larger and thicker; flagellum much longer, more slender apically; mesothorax and first abdominal segment more closely punctured; dorsum of thorax appearing very black, fringed with pale yellowish hair; abdominal bands paler, with turquoise tints; yellow lobe of hind tibia larger.

(C) Male antennæ ordinary; first abdominal segment with no green or blue band.

Nomia foxii Dalla Torre. New Mexico.

N. mesillensis Cockerell. New Mexico. Only the female is known, but I believe it falls in this group.

N. universitatis Cockerell. Colorado.

***NOMIA TETRAZONATA*, new species.**

Nomia tetrazonata ASHMEAD MS. (No description.)

Male.—Length about or hardly 10 mm., anterior wing $7\frac{1}{2}$; the four abdominal bands rather narrow, light turquoise blue, with slight green tints. Very close to *N. foxii* and *universitatis*, but uniformly smaller. Compared with *N. foxii* it is readily distinguished by the sculpture of the abdomen. In *foxii* the third segment has rather small, irregularly placed punctures of different sizes, while the fourth has very small punctures. In *tetrazonata* the fourth has large regular punctures like those on the third, while those on the fifth could not be called minute. The second segment is depressed basally. The hind femora are considerably stouter than in *N. universitatis*; the hind tibiæ are unusually

short, and seen from behind both they and their tarsi are of a uniform brown, hoary with fine pubescence; seen from in front, the apex of the tibial lobe is broadly yellowish-white; the anterior and middle tarsi are also brown. The punctures of the mesothorax are smaller than in *fozii* or *universitatis*. The face is covered with white hair, and the flagellum is dull ferruginous beneath. The tegulæ are as in *fozii*.

Habitat.—Globe, Arizona, July 25, 1892, three from Ashmead's collection; also one from "Bradsh. Mt.," June 21, 1892, also in Arizona, and from Ashmead's collection. Type from Globe, with number 147.

Type-specimen.—Cat. No. 12988, U.S.N.M.

DOUBTFUL AND EXCLUDED SPECIES.

Andrena valida Say. Viereck (in litt.) has suggested that this may be a *Nomia*. If so, it must be closely similar to *N. heteropoda*, being a large species with purplish-fuliginous wings.

Nomia birkmani Friese MS., Entom. News, 1899, p. 244, from Texas, has not been described.

N. compacta Provancher, 1888, from Cap Rouge, Canada, is based on a male, and from the locality and description I suspect that it may not be a *Nomia*. The following characters seem significant: "La face allongée, presque nue, le chaperon noir foncé, fortement tronqué en avant et légèrement réfléchi, brillant . . . pattes noires, brillantes, les cuisses et les jambes renflées, arquées, avec poils blancs peu denses, les tarses testacés-roussâtres . . . le septième [segment of abdomen] portant un petit appendice noir en forme de gouttière."

Paranomia venablesii Ashmead belongs to *Halictus* (*H. farinosus* Smith).

Nomia tacita Cameron is *Agapostemon sicheli* Vachal.

Nomia cillaba Cameron is also an *Agapostemon*.

Nomia cælestina Westwood is an *Agapostemon*.

A NEW FRESH-WATER AMPHIPOD FROM VIRGINIA, WITH SOME NOTES ON ITS BIOLOGY.

By GEORGE C. EMBODY,
Of Cornell University, Ithaca, New York.

During the spring of 1908 a number of amphipods were collected by the writer in a spring-fed pond near the town of Ashland, Virginia. Conspicuous among them, for their large size and relatively great abundance, were forms which were then supposed upon hasty examination to be *Eucrangonyx gracilis* (Smith). More careful study a year later, however, brought to light characters distinctly different from those mentioned in any description of the latter amphipod available to me.^a It is believed that these characters are sufficiently constant to warrant a description of this form as a new species.

I am indebted to Dr. I. F. Lewis, of Randolph Macon College, for collecting some forty additional specimens from the same pond where discovered in 1908. From these it has been possible to determine with some degree of accuracy the constancy of the characters noted. To Prof. James G. Needham, under whose direction this study has been made, I am especially grateful for constant advice. I desire, also, to express my sincere thanks to Prof. S. J. Holmes for his kindness in reading the manuscript and for valuable criticisms which he has offered.

EUCRANGONYX SERRATUS, new species.

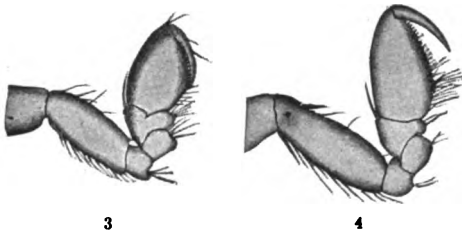
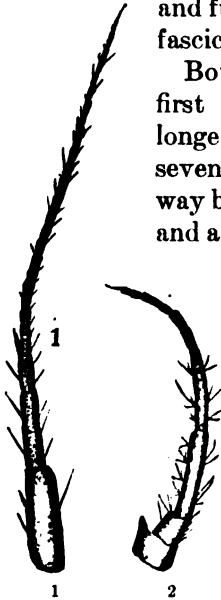
Description.—Eyes small, with few facets (about twenty-five); in diameter averaging seven-tenths the greatest breadth of the basal segment of the first antenna; circular or slightly elongated and densely pigmented with black.

First antenna approximating one-half the length of body; peduncle about one-third total length (fig. 1), with numerous setæ projecting from different points along the lateral margin of each segment; first segment equal to or slightly longer than second, third one-half to two-thirds of the first; primary flagellum consisting of from twenty to twenty-seven segments, each of which gives off from its distal margin two to five setæ; secondary flagellum composed of two segments, the

^a Smith, Am. Journ. Sci., ser. 3, vol. 2, 1871, p. 453. Forbes, Bull. Illinois State Lab., No. 1, 1876, p. 6. Stebbing, Das Tierreich. Amphipoda. 1. Gammaridea, 1906, p. 388. Weckel, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 32.

distal one, one-third to one-half the proximal and bearing two or three setæ.

Second antenna (fig. 2) about one-half as long as first; flagellum four-fifths as long as the peduncle and composed of from six to eleven segments, each giving off setæ similarly to those of the first antenna; peduncle longer or shorter than that of the first antenna and furnished with forty to sixty setæ, often arranged in fascicles of three.



FIGS. 1-4.—*E. SERRATUS*. 1, ANTENNA 1, $\times 11$ DIAM.; 2, ANTENNA 2, $\times 11$ DIAM.; 3, GNATHOPOD 1, $\times 11$ DIAM.; 4, GNATHOPOD 2, $\times 11$ DIAM.

Both pairs of gnathopods similar in the two sexes, the first pair (fig. 3) shorter than the second; propodus longer than broad, the breadth varying from six to seven-tenths of the length, greatest breadth about midway between the extremities; palm convex, very oblique, and armed on either side with from ten to thirteen notched spines of unequal length, one near the posterior angle more than twice the length of the others, and near this four or five smaller spines usually crowded together. Between each pair of notched spines are one or two long hairs. The whole margin of palm is closely set with very fine sharp teeth, to be seen with the high-power objective. Dactyl strongly curved, extending to or slightly beyond the posterior extremity of palm and furnished with two or three hairs. Posterior margin of propodus straight or slightly convex, with eight or ten hairs, some of which are finely plumose. Carpus as broad as long, posterior margin very convex, produced slightly and armed with two or three setæ and five or six plumose hairs; anterior margin somewhat convex, with one or two long bristles at its distal angle. Basal joint shorter than that of second gnathopod.

Second gnathopod (fig. 4) longer than first and differing from it as follows: Basal joint one-fourth to one-third longer than that of first gnathopod; propodus one-fifth longer with a larger number of bristles (14 to 18) arranged in fascicles on its posterior margin, its greatest breadth located nearer the proximal end, and hence a more oblique palm.

Fourth peræopod slightly longer than fifth, which is also longer than the first, second, or third; the third, fourth, and fifth with spines on both margins of the basal joints, which latter are also deeply and

acutely serrated along the posterior edges, forming great teeth in nearly all cases twice as long as the spines between them (fig. 5).

Pleopods with their outer rami slightly shorter than the inner.

Uropods one and two have equal rami; third, with inner ramus rudimentary and very short, about one-third as long as peduncle (fig. 6); outer ramus uniaarticulate, with three or four groups of spines on lateral margins and one group of two or three at the distal end. First pair of uropods extending backwards slightly beyond the second which in turn reaches to or slightly beyond the third.

Telson (fig. 7) longer than broad, longer than the peduncle of third uropod and with an emargination extending from slightly more than one-half to nearly two-thirds of the distance to base (see table), armed distally with three or four spines on each lobe and on the dorsal surface with three or four spines which seem to be definitely located within the mid-region.

The postero-lateral angles of the first three abdominal segments are produced backward, each into a tooth and provided with about five or six spines just above the ventral margin.

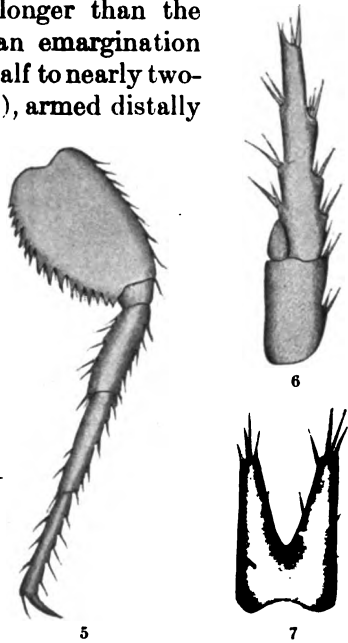
Size.—The largest specimen examined was a female with eggs and measured 14.5 mm. in length; the smallest adult, a male measuring 7.6 mm.

Eggs.—The average dimensions of six from different individuals were 0.39 by 0.485 mm.

Type-specimen.—Cat. No. 51290, U.S.N.M.

This species resembles *Eucrangonyx gracilis*, but differences exist in the telson, basal joints of the third to fifth peræopods, in the gnathopods, and in the size of the eggs.

The telson of *E. gracilis* is as broad as long (see table), not longer than peduncle of third uropod and cleft one-third to one-half the distance to base.^a In *E. serratus* it is longer than broad, longer than



FIGS. 5-7.—*E. SERRATUS*. PERÆOPOD 5, $\times 11$ DIAM.; 6, UROPOD 3, $\times 32$ DIAM.; 7, TELSON, $\times 32$ DIAM.

^a Early in the work variations in the depth of the emargination of the telson in *Eucrangonyx gracilis* were noted which had not been accounted for in the descriptions of that species given in the works cited in footnote on a previous page. In order to see just how far these variations had progressed, a number of specimens were collected from a trout brook near Auburn, New York, from Cayuga Lake at Ithaca, New York, and from a sphagnum bog at McLean, New York. The more conspicuous variations are recorded in the table of measurements on page 305.

peduncle of third uropod and cleft (typically) nearly two-thirds of the distance to base. The difference in the two species as regards the ratio of the length of peduncle of third uropod to the length of telson is constant in the newly hatched young as well as in the largest adult (see table).

In *E. gracilis* the third, fourth, and fifth peræopods have their basal joints serrated along the posterior margins but the spines are longer than the adjacent teeth. In *E. serratus* the depths of the serrations vary, but in all specimens examined the teeth were much longer and more acute than those of *E. gracilis* and about twice the length of the spines between them.

The propodi of gnathopods one and two are proportionately longer in *E. serratus*, the palms more oblique and more convex, and the carpus of second gnathopods never longer than broad.

Six segmenting eggs of *E. gracilis* were measured and an average size of 0.256 by 0.334 mm. was obtained, which was less than the same for *E. serratus*.

Habitat.—The type-specimens were collected March 11, 1908, from the marginal vegetation of "Railroad Pond," about 1½ miles north of Ashland, Virginia. They were especially abundant in the thickest patches of *Sphagnum* and *Utricularia* at depths varying from a few inches to 1½ feet. Associated with them were large numbers of *E. gracilis* and *Hyaella knickerbockeri* (Bate).

Differences between young and adult.—It was thought that by comparing the structures in the young of *E. serratus* with those of the adult and also with those of the young of *E. gracilis*, some light would be thrown upon the status of the former as a distinct species. Accordingly several young, differing not more than a day in age, were taken from the marsupial pouches of individuals of each form, the various appendages dissected, stained in aqueous eosin and mounted for microscopical examination.

The young of *E. serratus* were found to differ from their parents in the following particulars:

(1) First antenna (fig. 9): Primary flagellum composed of but four segments all proportionately longer than those of the adult.

(2) Second antenna (fig. 8): Flagellum composed of but three segments.

(3) First gnathopod (fig. 10): Great angularity of the region at the junction of the palm and the posterior margin of propodus. The latter is proportionately smaller and its posterior margin destitute of spines and hairs. The palm is straight, less oblique and thickly covered on both sides with minute sharp teeth. These teeth are much more evident in the young than in the adult.

(4) Second gnathopods (fig. 11): Palm straight or slightly concave, possessing a small angular prominence at the posterior extremity, the inner margin of this prominence together with the remaining margin of the palm closely set with minute teeth as in gnathopod one; posterior margin of propodus destitute of spines and hairs.

(5) Third, fourth, and fifth peræopods destitute of spines and serrations.

(6) Uropod one, shorter, not reaching backward to the end of second uropod.

(7) Uropod three (fig. 12), with three spines, two short ones at the apex and one long one on the outer margin of the outer ramus.

(8) Telson (fig. 16) with lateral margins very convex, not quite so long as in the adult but distinctly longer than peduncle of third uropod; emargination not quite so deep as in adult. The apex of each lobe is armed with a single spine while the mid-dorsal region of the telson is minus spines.

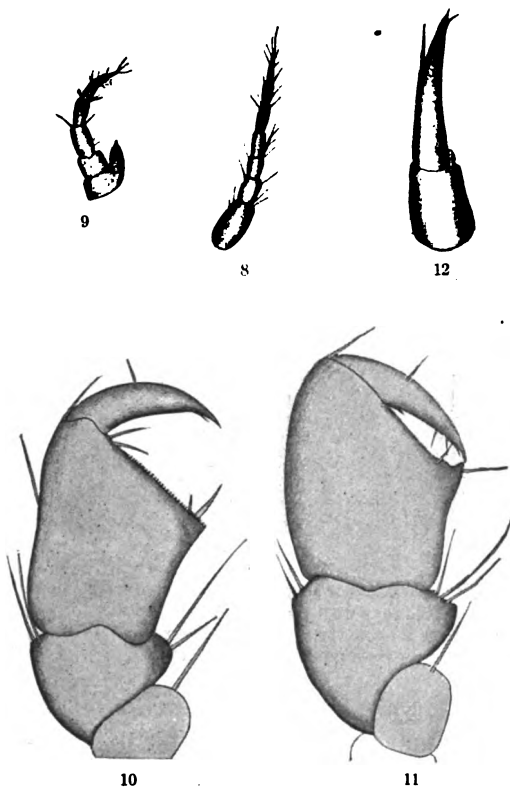
(9) Eyes brownish in life.

Differences between young of Eucrangonyx gracilis and E. serratus.—The following differences between the young of these two species were found to be constant in all specimens examined:

(1) Young *E. serratus* are 25 per cent longer than *E. gracilis*.

(2) The propodus of first gnathopod in *E. serratus* is broader distally, the palm forming a prominent angle of 45° or less with the posterior margin, which latter is decidedly concave. In *E. gracilis* (fig. 13), the junction of these two margins is well rounded.

(3) The palm in gnathopod two is decidedly more oblique in *E. serratus*, and as noted previously possesses an angular prominence at the



FIGS. 8-12.—*E. SERRATUS* (YOUNG). ANTENNA 1, $\times 32$ DIAM.; 9, ANTENNA 2, $\times 32$ DIAM.; 10, GNATHOPOD 1, $\times 150$ DIAM.; 11, GNATHOPOD 2, $\times 150$ DIAM.; 12, UROPOD 3, $\times 150$ DIAM.

posterior extremity which is entirely lacking in *E. gracilis* (fig. 14); carpus as broad as long in the former species, while in the latter it is longer than broad.

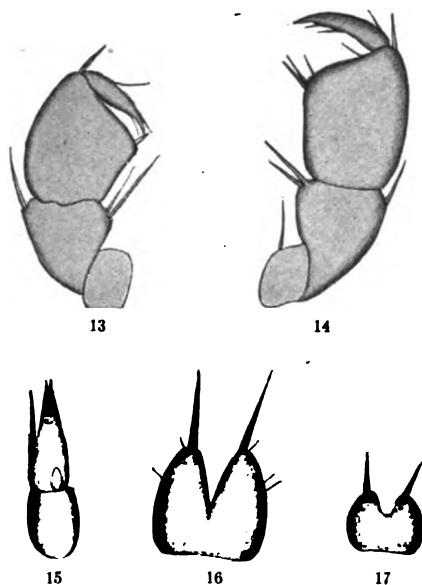
(4) The differences existing in the adult telson in the two species are present to some degree in the young. In *serratus* the telson is but slightly, if at all, longer than broad, much longer than peduncle of third uropod, emargination V-shaped and extending beyond one-half the distance to base (see table); that of *E. gracilis* broader than long, shorter than peduncle of third uropod, emargination U-shaped and extending about one-third the distance to base (figs. 15 and 17). In each species the telson is armed distally on each lobe with a single long, stout spine.

Notes on the reproductive capacity.—A large number of the specimens examined were females with eggs in their pouches. In many cases the eggs were counted and certain measurements taken in order to show some correlation between the number of eggs and the size or age of the individual, and to give an idea of the reproductive capacity of the species.

Several specimens of *E. gracilis* were treated in a similar manner for comparison. The results of the observations concerning both species are herewith given in tabular form.

An examination of this table shows clearly that in general the larger individuals, and hence the older, possess the larger number of segments in the primary flagellum of first antenna, and also that the larger complements of eggs are deposited by the larger females.

In the six largest individuals measured, those from 12.8 to 14.5 mm. long, the average number of eggs was eighty-two. In three individuals of medium size, from 9.7 to 11.5 mm. long, the average was forty-four.



FIGS. 13-17.—*E. GRACILIS* (YOUNG). GNATHOPOD 1, $\times 150$ DIAM.; 14, GNATHOPOD 2, $\times 150$ DIAM.; 15, UROPOD 3, $\times 150$ DIAM.; 16, *E. SERRATUS* (YOUNG). TELSON, $\times 150$ DIAM.; 17, *E. GRACILIS* (YOUNG). TELSON, $\times 150$ DIAM.

Table of measurements.

Species.	Total length, in millimeters. ^a	Number segments in primary flagellum of first antenna.		Number segments in flagellum of second antenna.		Telson.		Third uropod—length of peduncle; length of telson.	Sex.	Number of eggs.	Date.	Locality.
		Right.	Left.	Right.	Left.	Depth of cleft (length).	Breadth (length).					
<i>Eucrangonyx serratus.</i>	2.45	4	4	3	3	0.533	1.00	0.77	Young	.....	Mar. 16, 1909	Ashland, Virginia.
	2.26	4	4	3	3	.52	.954	.795	do.	.....	do.	Do.
	7.6	19	19	8	7	.52	.77	.82	Male	.....	do.	Do.
	8.3	17	18	8	8	.58	.80	.77	do.	.....	do.	Do.
	9.7	21	21	9	9	.507	.676	.76	Female	42	do.	Do.
	10.2	21	21	10	10	.607	.73	.76	Male	.....	do.	Do.
	10.7	23	22	10	10	.626	.723	.843	Female	.....	do.	Do.
	10.7	22	22	10	10	.626	.723	.843	do.	.....	do.	Do.
	11.5	23	23	10	10	.535	.666	.82	do.	46	do.	Do.
	12.00	24	24	10	9	.57	.685	.77	do.	.....	do.	Do.
	12.8	26	26	10	8	.61	.634	.66	do.	70	do.	Do.
	12.8	.....	.....	.....	.....	.....	.....	.....	do.	77	do.	Do.
	12.8	.....	.....	.....	.....	.....	.....	.....	do.	66	do.	Do.
	12.15	27	.....	10	11	.....	.....	.....	do.	.....	do.	Do.
	14.00	.....	.....	9	10	.....	.....	.....	do.	92	do.	Do.
	14.00	.....	.....	.....	.....	.63	.....	.....	do.	95	do.	Do.
	14.00	.....	.....	.....	.....	.63	.756	.81	do.	.....	do.	Do.
	14.5	27	27	11	11	.606	.702	.8	do.	88	do.	Do.
<i>Eucrangonyx gracilis.</i>	1.7	4	4	3	3	.322	1.29	1.19	Young	.....	Jan. 1909	Auburn, New York.
	5.6	18	18	.....	.....	.235	1.176	1.12	Female	25	do.	Do.
	6	19	19	6	6	.....	.....	.....	do.	.....	Mar. 26, 1909	Ithaca, New York.
	6	18	15	5	7	.5	1.00	1.22	Male	.....	Dec. 1909	Do.
	7.6	20	21	7	.....	.36	1.08	1.12	Female	34	Mar. 16, 1909	Ashland, Virginia.
	8.5	20	.....	.....	.....	.22	1.169	1.12	do.	69	May 12, 1909	Ithaca, New York.
	9	21	.....	.....	.....	.40	1.05	1.21	do.	93	Apr. 21, 1909	Do.
	9	22	.....	8	8	.316	1.10	1.08	do.	52	Mar. 16, 1909	Ashland, Virginia.
	9	22	.....	7	8	.50	1.16	1.11	do.	59	do.	Do.
	9	23	.....	9	.....	.26	1.24	1.24	do.	57	do.	Do.
	9.5	23	23	.....	.....	.50	1.00	.....	Male	.....	Apr. 21, 1909	Ithaca, New York.
	10.45	24	24	8	.....	.31	1.1	1.05	Female	68	Mar. 16, 1909	Ashland, Virginia.
	11.5	27	28	8	.....	.357	1.07	1.035	Male	.....	May, 1909	McLean Bog, New York.

^a Exclusive of the antennae.

The pond where this species lived in such great abundance was roughly 3 acres in area, fed by springs within the pond itself and by a small brook at one end. Fish were abundant and from an examination of stomachs of large-mouthed bass (*Micropterus salmoides*), common sunfish (*Lepomis gibbosus*), and calico bass (*Pomoxis sparoides*) it was found that they helped themselves liberally to amphipods. Especially was this the case with the smaller sunfishes and calico bass, 1 to 3 inches long, a few of which were able to penetrate the thick masses of sphagnum where amphipods were exceedingly numerous. This great fringe of vegetation about the pond, however, furnished a shelter which prevented at all seasons any very great destruction of amphipods by predatory animals, and this, together with the rather large reproductive capacity of the species in question, was sufficient reason for their great abundance.

DESCRIPTIONS OF EIGHT NEW SPECIES OF FOSSIL TURTLES FROM WEST OF THE ONE HUNDREDTH MERIDIAN.

By OLIVER P. HAY,
Of Washington, District of Columbia.

The new species of fossil turtles described on the following pages were collected during the summer of 1909 by members of the U. S. Geological Survey. Dr. T. W. Stanton, Mr. M. R. Campbell, and Mr. W. R. Calvert, working in Upper Cretaceous areas whose deposits are quite certainly equivalent to the Lance (Ceratops) beds of Wyoming, discovered the remains here described as *Basilemys præclara* and *Aspideretes amnigenus*. Mr. J. H. Gardner discovered, in the Ignacio quadrangle, La Plata County, Colorado, the complete plastron named below *Alamosemys annexa*. It seems uncertain to what formation the beds belong, but this turtle indicates that they are the equivalent of the Torrejon deposits of New Mexico. Later in the season, Mr. Gardner, accompanied by Mr. J. W. Gidley, of the U. S. National Museum, spent two days in the vicinity of Ojo Alamo, San Juan County, New Mexico. In this region they found two distinct formations. In the lower, composed of sandstones, clays, and a bed of conglomerate, there were found fragmentary remains of dinosaurs and the turtles below described as *Basilemys nobilis* and *Adocus vigoratus*, together with considerable parts of *Aspideretes vorax*? and unidentifiable fragments of other Trionychidæ. These beds are probably the equivalents of the Lance Creek beds. Above these dinosaur-bearing deposits came a deposit of conglomerate, about 12 feet thick at most. Succeeding this are other beds of sandstone and clay, in which were found no remains except those of the turtles described below as *Compsemys vafer* and *Hoplochelys bicarinata*, and probably *Compsemys parva*. It is possible, however, that the last-named species belongs to the older beds. It is believed that the deposits above the upper bed of conglomerate belong to either the Puerco or the Torrejon. It must be noted that Ojo Alamo is not more than about 100 miles from the Ignacio quadrangle in Colorado.

Although the Puerco and the Torrejon are usually assigned to the Lower Tertiary, it is the present writer's opinion that Professor Cope was right when he put them in the Upper Cretaceous.

The writer expresses here his obligations to the officers of the U. S. National Museum for the privilege of studying and describing the interesting materials above mentioned.

Genus *COMPSEMYS* Leidy.

The genus *Compsemys* has hitherto been known from only the most fragmentary materials and has had assigned to it a quite heterogeneous lot of species. Although the type is Leidy's *Compsemys victa*, of the Upper Cretaceous, it was for a long time supposed to be best represented by Cope's *Compsemys plicatula*, of the Upper Jurassic. In The Fossil Turtles of North America, page 47, the present writer removed the last-named species from *Compsemys* and assigned it to Marsh's genus *Glyptops*, a genus of Pleurosternidæ. Some scant materials in the American Museum of Natural History, believed to belong to *Compsemys victa*, led the writer to believe that the species possessed no mesoplastron and that it belonged among the Dermatemydidæ. In 1909, Mr. J. H. Gardner and Mr. J. W. Gidley discovered in probably Puerco or Torrejon deposits, near Ojo Alamo, New Mexico, materials representing the two new species of *Compsemys* described below. These materials show plainly that the genus had a very large mesoplastron and that it belongs to the superfamily Amphichelydia. The strong development of the axillary and the inguinal buttresses seem to ally the species with the Baënidæ, rather than with the Pleurosternidæ. The following definition of *Compsemys* is therefore proposed:

A genus of Baënidæ. Plastron relatively small, with broad mesoplastra which meet at the midline. Axillary and inguinal buttresses rising above the lower ends of the costals; these buttresses wide transversely to the body and shutting off ample sternal chambers. Peripheral bones united to costals by jagged sutures. Neural bones with the broader end forward. External surface of all the bones ornamented with small circular pustular elevations.

COMPSEMYS PARVA, new species.

The specimen which forms the type of the present species was collected by Messrs. Gardner and Gidley, at Ojo Alamo, San Juan County, New Mexico. The catalogue number in the U. S. National Museum is 6548. There is some doubt regarding the level at which the specimen was secured, but it is supposed that it came from the beds above the upper conglomerate; therefore above the dinosaur beds.

The individual was a small one, the length of the plastron having probably not exceeded 120 mm. There are present the greater part of both hypoplastra, a part of the right mesoplastron, a part each of

the right and the left hyoplastra, the greater portion of the left first costal bone, and parts of three other costals. All of these bones, except one of the costals, are illustrated here (Plate 10, figs. 1-3) by reproductions of photographs. The individual was not a young one, inasmuch as all the bones are closely sutured together. The bones, too, are relatively thick and solid. Fig. 1 presents a restoration of the plastron. Only the stippled portions are represented by bones actually known. Plate 10, fig. 1, represents the same bones placed in their natural relations.

The width of the hinder lobe is only 51 mm.; but this was probably narrow in comparison with the whole width of the shell, which was probably about 110 mm. wide.

The right hypoplastron is incomplete, since the outer anterior border and a part of the buttress are missing. Its length is 25 mm.; its thickness on the midline and on a line between the two buttresses is 6 mm.; where it joined the xiphiplastron, 3.5 mm. On the upper surface is a notch for a process of the xiphiplastron. But little of the subacute free border is preserved. Evidently the buttress was strong, and it probably ascended to the lower ends of the costals. The right hypoplastron is somewhat longer than the left and came into contact with the inner end

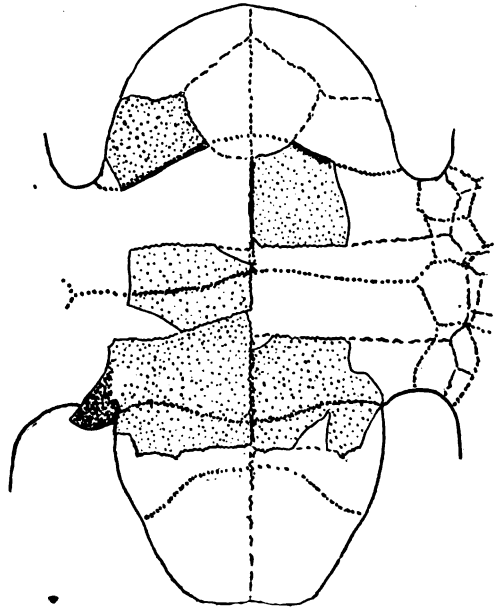


FIG. 1.—*COMPSEMYS PARVA*. $\times \frac{1}{2}$. RESTORATION OF PLASTRON. THE STIPPLED AREAS INDICATE THE PARTS ACTUALLY KNOWN.

of the left mesoplastron. The latter bone is 12 mm. wide near the inner end. How long it was transversely to the body can not be accurately determined, nor its distal width. It is 6 mm. thick at the front edge. It is remarkable how near to the inguinal notches the hypo-xiphiplastral suture is placed. The mesoplastron of the left side was considerably wider at the inner end than was the one of the right side, inasmuch as it came into contact with the right hypoplastron a distance of 3 or 4 mm., and probably for a short distance with the right hypoplastron.

The right hyoplastron lacks the outer and the anterior portions. It is thick behind, to correspond with the mesoplastron. In the ante-

rior inner angle there is a notch for a part of the border of the entoplastron. Of the right hyoplastron there is present the outer and anterior portion. The free border is rather obtuse. The sutural edge for contact with the epiplastron remains, as well as that for union with the entoplastron. In the latter notch the bone is 4 mm. thick. One can not be certain regarding the form of the epiplastron. It is not probable that there was any specially developed epiplastral lip. There are on both hyoplastra traces of the humero-pectoral sulcus. From the axillary notches it was directed inward and strongly forward to cross the entoplastron, thus differing from that of *Glyptops*. The pectoro-abdominal sulcus crossed the plastron along the middle of the mesoplastra. The abdomino-femoral sulcus starts behind the bases of the inguinal buttresses and swings somewhat backward on its way to the midline. The median sulcus of the plastron follows closely the sutures between the bones of the two sides. In most of the relatives of this species it runs a very irregular course. There was probably a series of inframarginal scutes on each bridge, but these do not appear on the specimen.

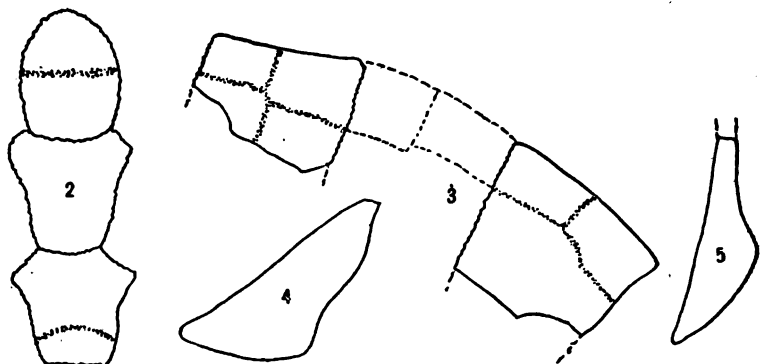
Of the left first costal (Plate 10, fig. 2) only the outer extremity is missing. The articulation with the peripherals was by means of dentated sutures. On the upper surface are parts of the first costal scute and of the first and second vertebrae. As the width of neither the nuchal nor the first neural bone is known it is impossible to determine accurately the width of the vertebral scutes represented. However, the first vertebral was considerably wider than the second. On the inferior surface of the bone is seen the ridge produced by the strongly developed rib, which forms an articulation with the axillary buttress. This buttress rose about 10 mm. above the lower border of this costal.

The costals represented by fig. 3 of Plate 10 belong to the left side. The one with the descending sulcus is probably the fourth from the front; and the next one, the fifth. These bones are about 3 mm. thick. The vertebral scutes extended out about 10 mm. from the neural borders. It is probable, therefore, that the vertebral scutes were not far from 30 mm. wide. All the bones of the specimen are ornamented with low, close-set elevations, or pustules, of which there are seven in a line 5 mm. long. Their summits are rounded and the valleys between them are of moderate width. In *C. victa* there is the same number of pustules in a 5 mm. line, but they seem to have more pointed summits and the intervening valleys are wider. In comparison with their width the bones of *C. parva* are considerably thicker than those of the type of *C. victa*. In *C. parva* the vertebral scute extends beyond the neural border of the costal a distance equal to the width of the costal; in *C. victa* the vertebral extends outward a distance equal to only two-thirds the width of the costal.

COMPSEMYS VAFER, new species.

The type of *Compsemys vafér* consists of about nine peripherals, three neurals, a few fragments of costal plates, and some fragments of the plastron. This material was collected by Messrs. Gardner and Gidley near Ojo Alamo, New Mexico, in deposits about 50 feet above the upper conglomerate, and therefore above the dinosaur-bearing beds. The catalogue number in the U. S. National Museum is 6551. At the same level the collectors obtained the right mesoplastron and right hypoplastron of one individual and the left hypoplastron of another, which are regarded as belonging to the same species as that numbered 6551. The three bones last mentioned are included under the catalogue number 6553.

Most of the bones of the first-named individual are covered with a layer of clay which is so hard that it is very difficult to remove it.



FIGS. 2-5.—*COMPSEMYS VAFER*. $\times \frac{1}{2}$. 2, FIRST, SECOND, AND THIRD NEURALS; 3, FIRST AND THIRD RIGHT PERIPHERALS, WITH RESTORATION OF THE SECOND; 4, SECTION OF FRONT END OF EIGHTH PERIPHERAL; 5, SECTION ACROSS TENTH PERIPHERAL.

Nevertheless a few of the bones are in satisfactory condition. It is estimated that the carapace had originally a length of about 1 foot. The three neurals (fig. 2) are the first, second, and third of the series. The form of each is seen from the figure. The first is 25 mm. long and 19 mm. wide; the second is 21 mm. long, 23 mm. wide, and 7 mm. thick; the third is 22 mm. long, 24 mm. wide, and 8 mm. thick.

One fragment of a costal is 26 mm. wide, 4 mm. thick at one edge, and 5 mm. at the other. Another fragment (Plate 10, fig. 4) is figured to show the sculpture. Proximal ends of the three costals vary from 5 to 6 mm. in thickness. Fig. 5 of Plate 10 represents the upper surface of the right first peripheral. It is 5.5 mm. thick where it joined the nuchal, 8 mm. where it joined the second peripheral. The free border is obtuse. On the lower side the sculptured surface extends backward from the edge 8 mm. at the end next the nuchal; 14 mm. at the other end. On the upper surface are portions of the first and

second marginal scutes and of the first vertebral and first costal. The second peripherals are both missing, but both third peripherals are present. The length along the obtuse free border is 37 mm.; the height, 33 mm.; thickness in front, 7 mm.; behind, 15 mm. As will be seen (fig. 3) the marginal scutes run low down on this peripheral also. One of the bridge peripherals, apparently the fourth, is 33 mm. long and rises above the surface of the plastron 25 mm. Six of the hinder peripherals are represented in the lot. The eighth has a height of 45 mm. The others have the upper border broken away. Fig. 4 represents the anterior end of the eighth; fig. 5 a section of probably the tenth. The free border of all these peripherals is sub-acute. The position of the sulci on them has not been determined. All the bones, where the outer surface is visible, present an ornamentation of pustules. They are flat topped and the intervening valleys are very narrow. There are usually seven pustules in a line 5 mm. long.

The fragments of the plastron tell little. One piece appears to belong to the right hypoplastron and to bear a part of the base of the buttress. Attached is a fragment of the mesoplastron. At the suture between the two bones the thickness is 6.5 mm. Another fragment, perhaps the inner end of the mesoplastron, is 8 mm. thick. On a fragment of a costal plate the sulcus bounding laterally a vertebral scute is 16 mm. from the neural border. Taking into consideration the width of the neural bones, the vertebral scutes must have been about 55 mm. wide.

Figs. 1 and 2 of Plate 11 represent the three plastral bones included under the catalogue number 6553. The right hypoplastron (Plate 11, fig. 1) has a length of 43 mm. At the hinder inner angle the thickness is 4 mm.; at the middle of the length, on the suture with its fellow, the thickness is 8 mm.; at the anterior inner angle, 6 mm. No part of the free border behind the inguinal buttress remains; hence the width of the hinder lobe can not be determined. It could not have been far from 90 mm. The mesoplastron (Plate 11, fig. 1) has a width of 23 mm. near the inner end; but even within a distance of 20 mm. the width has increased to 30 mm. At its inner end this bone is 7.5 mm. thick, but the thickness becomes somewhat reduced outward. The left mesoplastron was evidently wider at the inner end than the right, for it certainly articulated with the right hypoplastron on an oblique line 10 mm. long and probably with the right hypoplastron also. The left hypoplastron (Plate 11, fig. 2) agrees in all essential respects with the other. There is no possibility that the bone is the hypoplastron.

On viewing the lower side of these bones one is struck with the irregularity of the median sulcus. Between the abdominal scutes it formed a great loop, toward the right in one individual and toward

the left in the other. The abdomino-femoral sulcus runs straight across the hypoplastra from opposite the middle of the inguinal buttresses, thus differing considerably from that of *C. parva*.

On the right mesoplastron and hypoplastron the lower surface is mostly furnished with small pits and low ridges, but there are areas where these are replaced by pustules. Especially near the sutural borders the pustules are arranged in rows at right angles with the suture. The left hypoplastron is everywhere ornamented with pustules and this is doubtless the normal condition. The pustules have the size and flatness seen on the bones of the type specimen.

The sculpture of this species differs from that of both *C. victa* and *C. parva*. The neural of *C. victa*, the second, fourth, or possibly sixth, is 24 mm. long, 25 mm. wide, and 9 mm. thick. The third neural of *C. vafer* is only 8 mm. thick. It is greatly to be desired that more complete specimens of *C. victa* be collected in the type-locality.

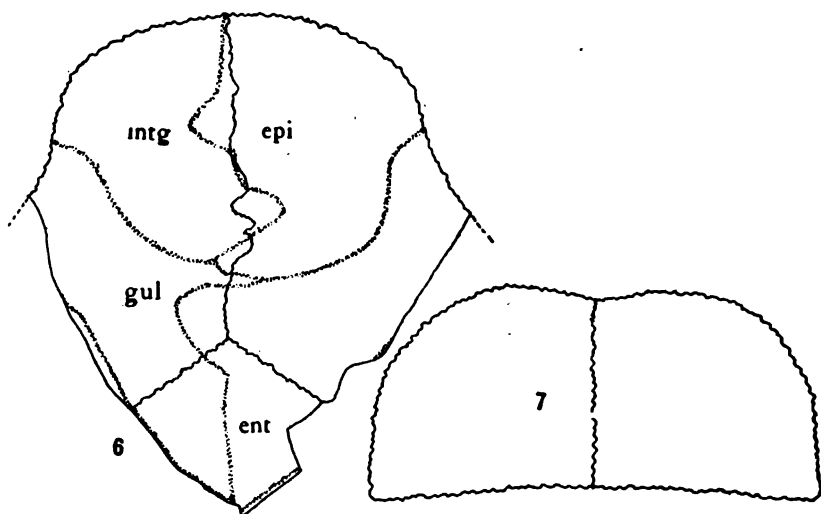
BASILEMYS PRÆCLARA, new species.

The remains on which this species is based were found on June 21, 1909, by a party of the U. S. Geological Survey consisting of Dr. T. W. Stanton, Mr. M. R. Campbell, and Mr. W. R. Calvert. The bones are accompanied by a note which states that they were found in the so-called somber beds, about 3 miles northeast of the mouth of Dirt Lodge Creek, South Dakota. The more accurate locality is given as section 12, township 20 north, range 22 east. This is in Boreman County, north of Grand River. In the same collection are bones of *Trachodon*, *Triceratops*, *Myledaphus bipartitus*, and other fossils belonging to the Lance formation, better known as *Ceratops* beds. The specimen consists of the epiplastral beak, a fragment of the rim of the posterior lobe of the plastron, the thickened anterior border of the nuchal, a free peripheral bone, and a number of fragments of the plastron and the carapace. The catalogue number of the specimen in the U. S. National Museum is 6540.

The most important part of the turtle here described is the epiplastral beak (Plate 10, fig. 6), and this indicates that the species is quite distinct from both *B. variolosa* and *B. sinuosa*. The individual had a size about that of the type of *B. sinuosa*; that is, the carapace was probably about 700 mm. long. This beak seems to differ from that of *B. sinuosa* in not being notched at the midline in front and in not being broadly channeled along the midline on the underside. It differs from that of *B. variolosa* in that it projects forward, at the gulo-humeral sulci, from the curvature of the remainder of the lobe. The lower surface of the fragment (fig. 6), which includes the whole length of the symphysis between the epiplastral bones and a part of the entoplastron, is very slightly concave, becoming convex and turned slightly upward in front. Fig. 7 shows a perpendicular trans-

verse section taken at the widest part of the fragment, which is apparently not far in front of the outer ends of the humero-pectoral sulci; fig. 8 presents a perpendicular section along the midline. The greatest thickness of the lip is 55 mm. Its width at the gulo-intergular sulci is 100 mm.; at the gulo-humeral sulci it must have been at least 120 mm. The lip of *B. sinuosa* is only 95 mm. wide at the latter-named sulci.

It is in the conformation of the intergular and gular scutes that are found the characters that most clearly distinguish this species from the two others mentioned. In *B. variolosa* the intergulars are very large and extend backward to or on the entoplastron; while the gulars are small and are crowded far away from the midline. In *B. sinuosa*

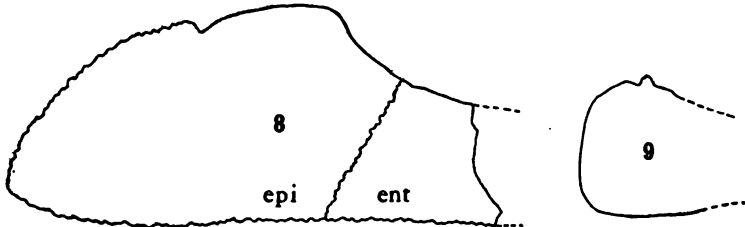


FIGS. 6, 7.—*BASILEMYS PRÆCLARA*. $\times 1$. 6, LOWER SURFACE OF FRONT END OF PLASTRON; *ent*, ENTOPLASTRON; *epi*, EPIPLASTRON; *gul*, GULAR SCUTE; *intg*, INTERGULAR SCUTE; 7, SECTION ACROSS FRONT END OF PLASTRON A LITTLE IN FRONT OF ENTOPLASTRON.

the intergulars are much like those of *B. variolosa*, but the gulars extend inward and join each other on the entoplastron. In *B. præclara* the intergulars lack much of reaching backward to the entoplastron, while the gulars meet each other on the epiplastra and the entoplastron. The anterior end of the sulcus between the gulars is about 66 mm. behind the front of the lip; the hinder end about 124 mm. behind the front.

A fragment of the rim of the plastron belongs behind the left inguinal notch and includes the suture between the left hypoplastron and the left xiphiplastron. The thickness of the bone at the suture is 47 mm. Fig. 9 shows a section taken 40 mm. behind this suture. The outer sculptured surface of the bones rises nearly perpendicularly from the flat lower surface to the summit of the ridge that

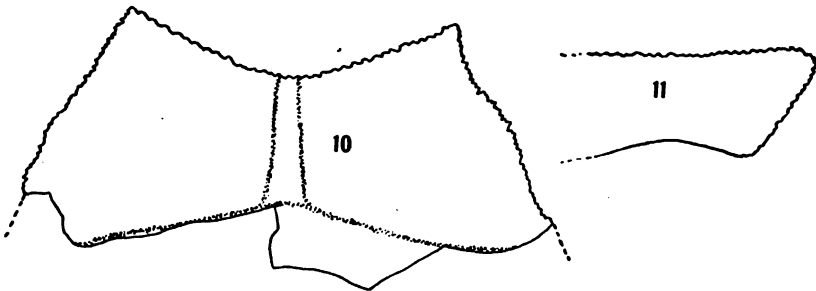
runs backward from the inguinal notch. Fig. 10 represents the outline of the anterior part of the nuchal bone, while fig. 11 shows the section of the bone where it joined the first peripheral. From one extremity of the bone to the other, at the anterior border and in a straight line, the distance is 87 mm. The greatest thickness of the bone is at the midline and amounts to 36 mm. The nuchal scute is 32 mm. long, 5 mm. wide in front, and 11 mm. behind. On the



FIGS. 8, 9.—*BASILEMYS PRAECLARA*. $\times \frac{1}{4}$. 8, MEDIAN SECTION OF FRONT OF PLASTRON; *ent*, ENTOPLASTRON; *epi*, EPIPLASTRON; 9, SECTION OF FREE BORDER OF XIPHIPLASTRON 40 MM. BEHIND HYPOPLASTRON.

antero-inferior surface of the bone this nuchal scute broadens to a width of 25 mm. where it joined the soft skin.

There is present the thickened border of one free peripheral, probably one of the hinder ones. It is 90 mm. long at the free edge and has a maximum thickness of 26 mm. On the inferior surface the sculpture rises to a height of 45 mm. The bone is crossed by a sulcus between two marginal scutes. The sulci found on the various bones present great contrasts. Sometimes they are extremely narrow



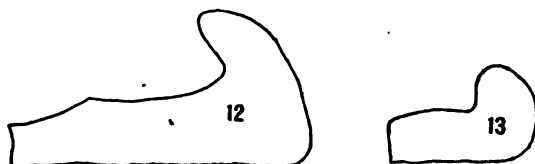
FIGS. 10, 11.—*BASILEMYS PRAECLARA*. $\times \frac{1}{4}$. 10, UPPER SURFACE OF FRONT OF NUCHAL; 11, SECTION ACROSS NUCHAL NEAR UNION WITH FIRST PERIPHERAL.

and shallow and can hardly be followed over the pits and ridges, while others are broad and sometimes deeply impressed. The bones are sculptured as in the two other species of the genus that have been mentioned. The ornamentation consists of pits separated by sharp ridges, and the latter rise into points at the boundary between three pits. On some parts of the carapace the pits are shallow, resembling those of some *Trionychidae*. The lower surface of some of the plastral bones are rough but often devoid of the pits.

BASILEMYS NOBILIS, new species.

Among the turtle remains collected by Messrs. Gardner and Gidley at Ojo Alamo, New Mexico, are some portions of a species of *Basilemys*. These remains were found below the upper conglomerate bed, in the dinosaur-bearing deposits and about 50 feet above the lower conglomerate. There are many fragmentary parts of both the carapace and the plastron, but the most important part is the border of the right side of the hinder lobe of the plastron, including a portion of the hypoplastron and a part of the xiphiplastron. The bones present indicate a large turtle, one of nearly the size of the type of *Basilemys variolosa*, the type of the genus, the plastron of which was about 670 mm. long. The catalogue number of the type of *Basilemys nobilis*, here described, is 6555.

The right extremity of the fragment of hypoplastron reaches out to the suture with the eighth peripheral. From this suture to that between the hypoplastron and the xiphiplastron, following the curve,



FIGS. 12, 13.—*BASILEMYS NOBILIS*. $\times \frac{1}{2}$. 12, SECTION ACROSS FREE BORDER OF XIPHIPLASTRON 40 MM. BEHIND HYPOPLASTRON; ON THE LEFT THE SECTION ENTERS DEPRESSION FOR PUBIS; 13, SECTION ACROSS FREE BORDER OF XIPHIPLASTRON 115 MM. BEHIND HYPOPLASTRON.

is 102 mm. Near the former suture the bone is 52 mm. thick. From the border of the inguinal notch a wall extends backward along the border of the hinder lobe. At the hypo-xiphiplastral suture this wall rises 40 mm. above the lower surface of the

plastron. From the summit of the wall the bone slopes downward rapidly and about equally on the outside and the inside of the wall. Where the slope ceases on the inner side of the wall the xiphiplastron is about 17 mm. thick. Passing backward 40 mm. the wall is somewhat higher, slightly steeper on the outside and overhanging on the inner side (fig. 12). At a distance of 60 mm. behind the hypo-xiphiplastral suture the wall is 36 mm. high and still more overhanging on the inner side. At the base of the wall here the thickness of the xiphiplastron is 21 mm. As the rear of the xiphiplastron is approached the wall becomes lower, only 25 mm. where the fragment ends (fig. 13). On the upper surface of the xiphiplastron there is a large oval scar which was occupied by the pubis.

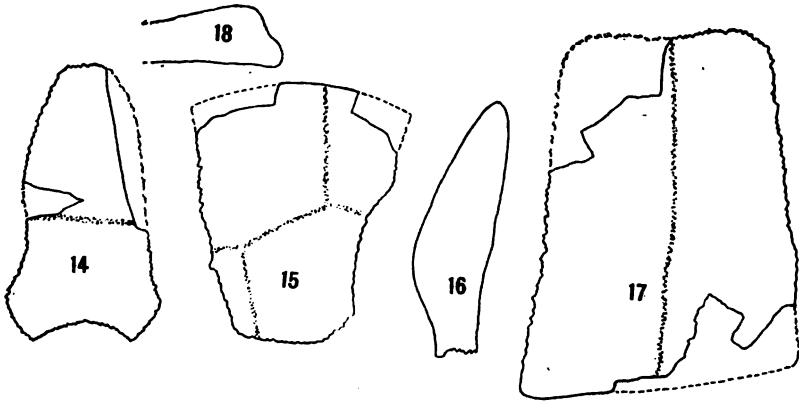
On the lower surface of the outer extremity of the hypoplastron are seen the narrow thread-like sulci which bound the inguinal scute. This is only 25 mm. wide and it is thrown well out on the extremity of the bone. In *B. variolosa* this scute is much wider and extends medially to the free border of the hinder lobe. On the sloping

outer face of the xiphiplastral wall, near the hinder end of the specimen, is seen a part of the femoro-anal sulcus.

From *B. præclara*, described above, this species differs in at least one important respect, the inner slope of the wall around the border of the hinder lobe of the plastron; as will be seen on comparing figures 9 and 12. It differs from *B. sinuosa* in about the same way; for in the latter the upper surface of the xiphiplastron slopes rapidly downward toward the central portion of the lobe. The writer has not at hand information regarding the same region in *B. variolosa*, but it probably does not differ in any important respect from that of *B. sinuosa*.

ADOCUS VIGORATUS, new species.

The fragmentary remains which are described under the above-given name were collected September 3, 1909, by Messrs. Gardner



FIGS. 14-18.—*ADOCUS VIGORATUS*. $\times 1$. 14, FIRST NEURAL; 15, FIRST LEFT PERIPHERAL; 16, SECTION ACROSS FIRST LEFT PERIPHERAL, THE UPPER SURFACE TOWARD RIGHT; 17, LEFT SEVENTH PERIPHERAL; 18, SECTION ACROSS FREE BORDER OF BASE OF HINDER LOBE.

and Gidley, at Ojo Alamo, San Juan County, New Mexico. The bones were secured below the upper bed of conglomerate, in those beds which furnished remains of dinosaurs. The specimen bears the number 6554 of the catalogue of the U. S. National Museum.

The individual was one of considerable size, the length of the carapace having been probably 500 mm. One neural (fig. 14) present is probably the most anterior one. It is narrowed in front, notched behind, and crossed by the sulcus that passed probably between the first and the second vertebral scutes. The length is 68 mm. along the midline; the width is 40 mm. The anterior end was about 6 mm. thick; the posterior, 10 mm. Fig. 15 represents the form of the first left peripheral, while fig. 16 presents a section from the free border to the border that articulated with the first costal. The bone is about 53 mm. wide along the anterior border and 67 mm. high. Its greatest thickness is 19 mm., and this is the same

where the bone joined the nuchal and where it joined the second peripheral. The free border is obtuse. On the upper surface are seen part of the first vertebral scute, a part of the first costal scute, and parts of the first and the second marginal scutes. The ascending plate of one of the bridge peripherals is penetrated by the extremity of a rib.

Fig. 17 presents a view of the left seventh peripheral. Its length near the free border is 73 mm.; its height is 96 mm. The free border is subacute. The front border is greatly thickened, to form a shoulder to receive the inguinal buttress of the plastron. This buttress did not rise to the lower borders of the costals. On the upper part of the inner face of the bone is a shallow groove in which lay the end of the rib of the fifth costal plate. Farther down this rib enters the bone and descends a distance of 44 mm. from the upper border.

Of the plastron there are present a fragment of the right xiphiplastron and the portion of the hypoplastron that sends up the right inguinal buttress. Fig. 18 represents a section taken just behind this buttress. It shows the thickness of the bone and the form of the free border at the base of the hinder lobe. The underside of the fragment shows the outer end of the abdomino-femoral sulcus. The xiphiplastron is quite thin, the thickness just behind the femoro-anal sulcus being only 6 mm. The free edge is acute. The sulcus just named is directed forward as it moves toward the midline.

The outer surfaces of all the bones, those of the plastron as well as those of the carapace, are ornamented with shallow pits arranged in more or less regular rows. The rows are directed obliquely to the sutural borders of most of the bones (Plate 11, fig. 3). There are three rows of pits in a line 5 mm. long. The ridges between the pits are rounded on their summits and the cross ridges are feeble.

This species is evidently different from all of those described from the eastern region of the United States. From *A. lineolatus*, the type of which came from Colorado, the present species differs in having a coarser sculpture, three rows of pits in a 5 mm. line, instead of four or five.

ALAMOSEMYS ANNEXA, new species.

The type of this species was found by Mr. J. H. Gardner, of the U. S. Geological Survey, in the Ignacio quadrangle, La Plata County, Colorado. The exact locality is given as section 1, township 34 north, range 8 west. The following note accompanied the specimen: "Turtle bones from the top of the Animas or above." This refers to the Animas formation. Inasmuch as the type of the genus *Alamosmys substricta* was found in the Torrejon of New Mexico,^a it appears

^a Mr. Walter Granger, the discoverer of this turtle, informs me that it was found in a dry sand arroyo east of Escavada canyon. The locality is near the southeastern corner of San Juan County, close to the line between this county and what is now McKinley County.

probable that the same formation occurs in the Ignacio quadrangle. The number of the specimen in the catalogue of the U. S. National Museum is 6539.

No part of this specimen is present, except the plastron. Of this little is missing. The character which is depended on to separate the genus *Alamosemys* from *Adocus* is the restriction of the marginal scutes to the peripheral bones. As these bones are wholly missing, this character can not be observed. However, the plastron is so closely like that of *A. substricta*, the type of the genus, that there can be hardly a doubt that this species, too, belongs to *Alamosemys*.

The individual was somewhat smaller than the type of *A. substricta*, the total length of the plastron being 335 mm., from which it is estimated that the carapace was about 445 mm. long. The carapace of the type of *A. substricta* is 550 mm. long.

Fig. 19 shows the form and proportions of the plastron as well as the form and proportions of its various bones and horny scutes. The following table presents three columns of measurements. In the first column are certain measurements taken from the type of *A. substricta*; in the second are corresponding measurements taken from the plastron here described; while in the third column are the measurements of the first column reduced by 16 per cent of their value. This reduction is made for the following reason: The length of the anterior lobe of *A. annexa* is made the standard of comparison and this is 84 mm. long. That of *A. substricta* is 100 mm., which reduced by 16 per cent becomes 84 mm. All the other measurements of *A. substricta* being reduced in the same proportion, we have the figures of the third column, which, on comparison with those of the second column, show the agreements and differences in these measurements of the two species.

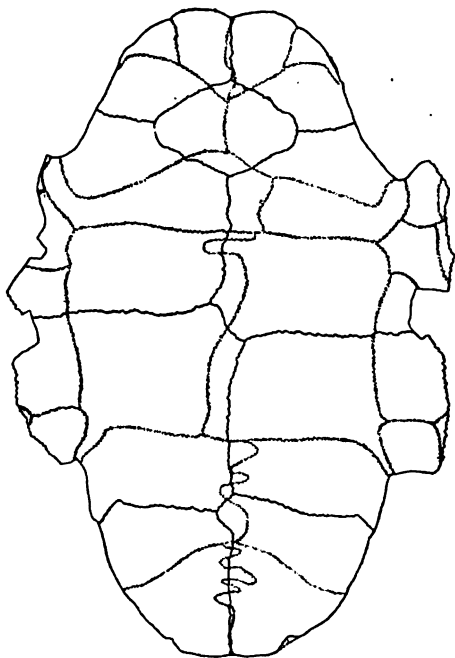


FIG. 19.—ALAMOSEMYS ANNEXA. $\times 1$. LOWER SURFACE OF THE PIASTRON.

Table of measurements.

Parts measured.	<i>A. substricta.</i>	<i>A. annera.</i>	<i>A. substricta</i> reduced
	mm.	mm.	mm.
Length of anterior lobe.....	100	84	84
Width of anterior lobe.....	209	177	175
Thickness of edge near front.....	9	8	7.5
Length of entoplastron.....	55	51	46
Width of entoplastron.....	90	71	76
Width of bridge.....	180	160	151
Length of posterior lobe.....	132	100	110
Width of posterior lobe.....	190	163	160
Contact of hyo and hypoplastral bones.....	100	72±	84
Contact of hypoplastral bones.....	135	100±	113
Contact of hyo and hypoplastral bones taken together.....	235	173	197
Length of intergular sulcus.....	50	43	42
Combined width of intergulars.....	75	65	63
Length of interhumeral sulcus.....	48	28	40
Length of interpectoral sulcus.....	46	40	39
Length of interabdominal sulcus.....	128	110	108
Length of interfemoral sulcus.....	80	52	67
Length of interanal sulcus.....	67	61	56

The anterior lobe is rounded in front, without appearance of epiplastral lip. Its free borders are subacute. Seen from above, the bones thicken from this edge, until at about 15 mm. from the edge they have a thickness of from 7 to 9 mm. The upper surface of the lobe is nearly flat. The buttresses, anterior and posterior, are little developed. The entoplastron differs from that of *A. substricta* in being somewhat pointed behind, instead of rounded or subtruncated. It is longer than that of *A. substricta* in the ratio of 51 to 46, and narrower in the ratio of 71 to 76. It will be observed that there is a union of the left hyoplastron with the right hypoplastron and a similar connection between the latter bone and the left xiphiplastron. Such irregularities are probably only individual peculiarities, but similar ones are quite common among the ancient turtles.

It is seen that the hyoplastra and the hypoplastra are shorter than in *A. substricta*, relatively to the length of the anterior lobe. The bridge, too, is shorter. The free border of the hinder lobe is somewhat less acute than that of the anterior lobe. At the hypo-xiphiplastral suture the bones are 9 mm. thick. On the midline, 30 mm. behind the suture just mentioned, the thickness is only 7 mm. The free borders of the xiphiplastra posteriorly are acute. On the upper surface of each xiphiplastral there is a crescentic elevation for attachment of the pubic bone.

The lower surface of the plastron is very indistinctly sculptured. The appearance is as if there were rows of small pits, as in *Adocus*; but they are so faintly impressed that they are hardly to be detected.

It will be seen that many of the horny scutes had very irregular boundaries. Especially the median sulcus runs a very tortuous course. The gular and intergular scutes differ little from those of *A. substricta*. The humero-pectoral sulcus crosses the hinder border

of the entoplastron. In *A. substricta* the sulcus is only tangent to the bone. The line of contact between the right and the left humerals is thus shorter than in *A. substricta* in the ratio of 28 to 40, as is shown in the second and third columns of the table. The pectorals of the two species have the same relative length, as also the abdominals have. The hinder lobe of *A. annexa* is more narrowed posteriorly than that of *A. substricta*. On each bridge there are four inframarginal scutes, which resemble closely those of the type of the genus.

Genus HOPLOCHELYS Hay.

Supported by the materials described below under the name *Hoplochelys bicarinata* the writer ventures to add to the definition of the genus that was given in his work *The Fossil Turtles of North America*, page 263.

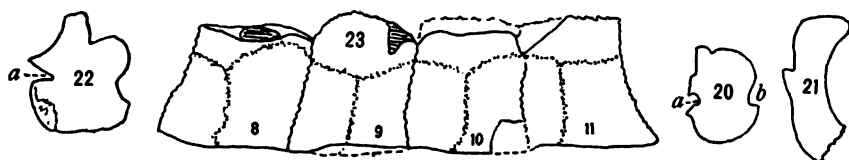
Shell thick and solid. Peripherals united to the plastral bones by means of digitations and dentated sutures; with the costals by gomphosis and in some cases by simple apposition, in others by close sutures. Carapace furnished with three dorsal carinæ, the median sometimes feebly developed. Plastron with the anterior and posterior lobes immovable and with the posterior narrow. A row of inframarginal scutes on each bridge. Pectoral and femoral scutes meeting and crowding the abdominals from mutual contact at the midline. Intergulars and gulars wanting, or consolidated with the humerals.

HOPLOCHELYS BICARINATA, new species.

The type of the present species has the catalogue number 6549 of the U. S. National Museum. It was collected September 2, 1909, at Ojo Alamo, San Juan County, New Mexico, by Messrs. Gardner and Gidley. It is stated to have been found 50 feet above the upper bed of conglomerate, and it therefore belongs probably to either the Puerco or the Torrejon. The type of the genus is *Hoplochelys crassa* (Cope). This was secured by Cope's collector at Chaco Canyon, San Juan County, New Mexico, but there is uncertainty whether in the Puerco or the Torrejon. Two other species of the genus, *H. saliens* and *H. paludosa*, are from the Torrejon; a third, *H. cæolata* Hay, is from the Fort Union of Montana, but the beds appear to be equivalent to the Torrejon.

Of the specimen here described there are present parts of two neurals, one complete costal, the left fourth, and parts of several others, eleven peripherals, and the greater part of the plastron. The bones are thick and the shell was heavy and solidly constructed. The outer surface of all the bones is undulating, but smooth, and there is no ornamentation of any kind. The carapace (Plate 12, fig. 1) had originally a length of about 175 mm. and a width of about 140

mm. The shell was high and strongly arched from side to side. Along the back ran a very feeble median keel and on each side a strong lateral keel. The lateral keels are not as acute on their summits as are those of *H. crassa*, but are rounded. On the side toward the midline the base of each lateral keel is bounded by the deep and sharply impressed sulcus which limits laterally the vertebral scutes. Just in front of the sulcus which descends between contiguous costal scutes the keel rises abruptly from the costo-vertebral sulcus and then rounds off into the general level of the costal bone. On the slope of the keel toward the median line a well-defined groove begins at the crossing of the descending sulcus and runs backward, gradually disappearing before reaching the next descending sulcus. The second neural is 25 mm. long, 16 mm. wide, and 7 mm. thick; the fourth, not present, had a length of about 23 mm.; the fifth is 18 mm. wide and 9 mm. thick near the anterior and its length was approximately 14 mm. The left fourth costal plate is 23 mm. wide where crossed by the costo-vertebral sulcus; 27 mm. at the distal end. Where it



FIGS. 20-23.—*HOPLOCHEILUS BICARINATUS*. $\times \frac{1}{4}$. 20, FRONT END OF FOURTH PERIPHERAL—*a*, GROOVE FOR PROCESS OF HYOPLASTRON; *b*, LATERAL CARINA WITH GROOVE ABOVE IT; 21, HINDER END OF FOURTH PERIPHERAL; 22, FRONT END OF EIGHTH PERIPHERAL—*a*, PIT FOR PROCESS OF HYOPLASTRON; 23, EIGHTH, NINTH, TENTH, AND ELEVENTH PERIPHERALS.

joined the neural the thickness is 8 mm.; through the lateral keel, 8 mm.; through the distal end, 5 mm. The rib-heads were rather slender. The nuchal bone and both of the first peripherals are missing. The third peripheral is 27 mm. long; the fourth, 24 mm.; the fifth, 21 mm.; the sixth, 21 mm. The seventh is wanting on both sides. The eighth is 25 mm. long; the ninth, 24 mm. At its front the third peripheral is 23 mm. high and 9 mm. thick. The succeeding three are equally thick. Fig. 20 represents the front end of the fourth and fig. 21 the hinder end. The latter articulated with the anterior process of the hyoplastron. This process continued forward in a deep groove along the inner face of the fourth peripheral and entered a pit in the third. There is also a small pit in the third for the rib of the first costal, and in the fourth a larger one for the rib of the second costal. Doubtless there were pits in the succeeding three peripherals for the corresponding ribs, but the upper borders of these peripherals are broken away. The hinder end of the lower border of the fourth, the whole lower border of the fifth, and the anterior end of the lower border of the sixth peripherals formed a

jagged suture with the hyoplastron. The remainder of the lower border of the sixth and the whole of the same border of the seventh peripherals were similarly joined to the hypoplastron. The eighth (figs. 22, 23) has a pit in the inner face of its anterior end for a process of the hypoplastron. The anterior end of the eighth is 18 mm. thick, the posterior end 12 mm. The ninth peripheral (fig. 23) is 27 mm. high, and it has a pit near the hinder end of its upper border. The tenth peripheral (fig. 23) seems to have had a pit for the rib of the last costal plate. There is another peripheral (fig. 23) which appears to be the eleventh of the left side. It presents no pit in its upper border. Its border for the pygal is 9 mm. thick. The upper border of the third peripheral of the left side indicates that it joined the second costal by a jagged suture, and the same sort of union is betrayed by the distal end of what appears to be the second costal. The distal end of the fourth costal was evidently similarly sutured to the sixth peripheral. It is probable that all of the costals above the bridges were closely joined to the corresponding peripherals. The ninth peripheral has the upper border thin and smooth; the eleventh has this border jagged. From the somewhat upturned free border of the third peripheral a low keel, bounded above by a groove, is continued backward on the bridge peripherals, descending again to the free border of the eighth and succeeding peripherals.

Of the plastron there are missing the left epiplastron, the outer extremity of the left hypoplastron, the whole of the right xiphiplastron, and the hinder end of the left xiphiplastron. The form of the plastron and of its various bones is shown by the figure (Plate 12, fig. 2) The total length of the plastron was close to 130 mm. The anterior lobe is 40 mm. long and 70 mm. wide at the base. The free border is obtuse and about 5 mm. thick. There is no suggestion of an epiplastral lip. The entoplastron is 26 mm. long, 26 mm. wide, 9 mm. thick, pointed in front and broadly rounded behind. The hypoplastra joined a distance of 25 mm. on the midline; the hypoplastrals, 26 mm.; the xiphiplastrals probably about 40 mm. The hinder lobe was close to 48 mm. long and 55 mm. wide at the base. The greatest thickness of the hypoplastra is 14 mm.; of the xiphiplastra, 9 mm.

The sulci of the carapace are narrow, but deeply impressed. The sulci descending on the second, fourth, and sixth costal bones are nearer the hinder border of the bones. The second vertebral scute was evidently 34 mm. wide. The third was 36 mm. wide and about 45 mm. long. The costo-marginal sulci run along just below the upper borders of most of the peripherals, descending on the hinder peripherals to about the middle of their height. The intermarginal sulci descend a little in front of the middle of the length of the peripherals.

The scutes of the plastron (Plate 12, fig. 2) have a remarkable arrangement. On each bridge are two inframarginals, an anterior and a posterior. The anals and the femorals can be identified without doubt. The femorals extend forward to the hyo-hyoplastral suture. In front of the femorals is a pair of large scutes that reach nearly the middle of the entoplastron and overlap the hinder ends of the epiplastron. On each side, lying between the scutes just described and the inframarginals, is another large scute that extends from the axillary to the inguinal notch and inwardly to within about 18 mm. of the midline. It seems that these last-mentioned scutes must be the abdominals which, as in *Chelydra*, have been crowded from the midline by the expansion of the pectorals and the femorals. There are no traces of intergulars. Gulars and humerals remain to be accounted for, and only a single pair remains. It seems probable that the gulars have been suppressed or have coalesced with the humerals. The arrangement of the plastral scutes of this genus resembles that of *Baptmys tricarinata*,^a except that the abdominals of *Hoplochelys* have been excluded from the midline.

This species differs from *H. crassa* (Cope) in having the lateral keels of the carapace broader and more obtuse. *H. crassa* also evidently had the abdominal scutes pushed away from the midline. The width of these at the inguinal notch was about 13 mm.; whereas, in *H. bicarinata*, a larger individual, these scutes are only 5 mm. wide.

From *H. cælata*^b the present species differs in not having the bones sculptured with oblique ridges. The outer faces of the hinder peripherals are not flat, as they are in *H. cælata*, but more or less concave, with the free borders somewhat upturned. In *H. cælata* the hypoplastron did not enter the eighth peripheral. The hinder end of the seventh is thin, as is also the whole of the eighth. In *H. bicarinata* the anterior end of the eighth is much thickened and receives a process from the hypoplastron. The hypoplastron of *H. crassa* (Cope) does not pass behind the seventh peripheral, resembling in this respect *H. cælata*.

ASPIDERETES AMNIGENUS, new species.

The writer ventures to describe as a new species a trionychid turtle which was secured by the same party that discovered the type of *Basilemys præclara* and in the same locality and formation. The catalogue number in the U. S. National Museum is 6574. This turtle is represented by the greater part of one costal plate (Plate 11, fig. 4), which appears to be the second of the left side. Of this costal there is present all except a small portion near the middle of the

^a Hay, Fossil Turtles of North America, p. 276, figs. 347, 348.

^b Hay, Proc. U. S. Nat. Mus., vol. 35, p. 163, pl. 27.

length and a part of the hinder border near the distal end. Originally the costal had a length of about 180 mm. The breadth at the neural end is 41 mm; at the middle of the length, 51.5 mm. The thickness where the bone joined the neurals is 7 mm.; at the middle of the length, on the front border, 13.5 mm.; on the hinder border, 10 mm.; through the ridge formed by the rib at the distal end, 14 mm. The greater thickness of the anterior border, in the middle of the length, is due to the fact that the rib lies on the anterior half of the inferior surface. The free border of the carapace seems to have been cut off nearly at right angles with the upper surface, not beveled off as in many species of the family.

It is in the sculpture of the upper surface that is found a character which appears to distinguish this species from its relatives. The upper surface is furnished with a system of ridges which rise quite abruptly from the nearly plane intervals between them. Usually in the trionychid tortoises the ridges anastomose so as to produce pits more or less regular in form and size. In the present species the ridges show little tendency to anastomose, and on the proximal two-thirds of the costal there are comparatively few distinctly inclosed pits. On the proximal third the ridges run in no predominant direction and are interrupted and usually short. Many separate little hillocks are present.

On the median third of the costal the ridges, about 3 mm. apart, run mostly at right angles with the intercostal sutures and there are long flat valleys between them, but the ridges are often broken up into rows of hillocks. On the distal third of the costal the ridges are more irregular in their courses and are more often connected by cross ridges, so that there are definitely formed pits. These become more reduced in size as the free border is approached. Over the whole surface, but somewhat less conspicuously on the ridges, are seen the openings of minute vascular canals.

EXPLANATION OF PLATES.

PLATE 10.

Figs. 1-3. *Compsemys parva* $\times 1$.

Fig. 1. Plastral bones. On the left above, a part of the right epiplastron; on the right above, a part of the left epiplastron; below, the right and left hypoplastra.

2. Left first costal bone.

3. Two left costals, probably the fourth and fifth.

Figs. 4, 5. *Compsemys vafer* $\times 1$.

Fig. 4. A fragment of a costal, to show the ornamentation.

5. Part of right first peripheral.

6. *Basilemys praeclara* $\times \frac{1}{3}$. View of the upper surface of the epiplastral lip.

PLATE 11.

Figs. 1, 2. *Compsemys vafer* $\times 1$.

Fig. 1. Median ends of mesoplastron and hypoplastron of right side, seen from below.

2. Left hypoplastron of another individual.

3. *Adocus vigoratus* $\times 1$. A part of a peripheral above the bridge, to show the ornamentation. The upper border of the bone is toward the left.

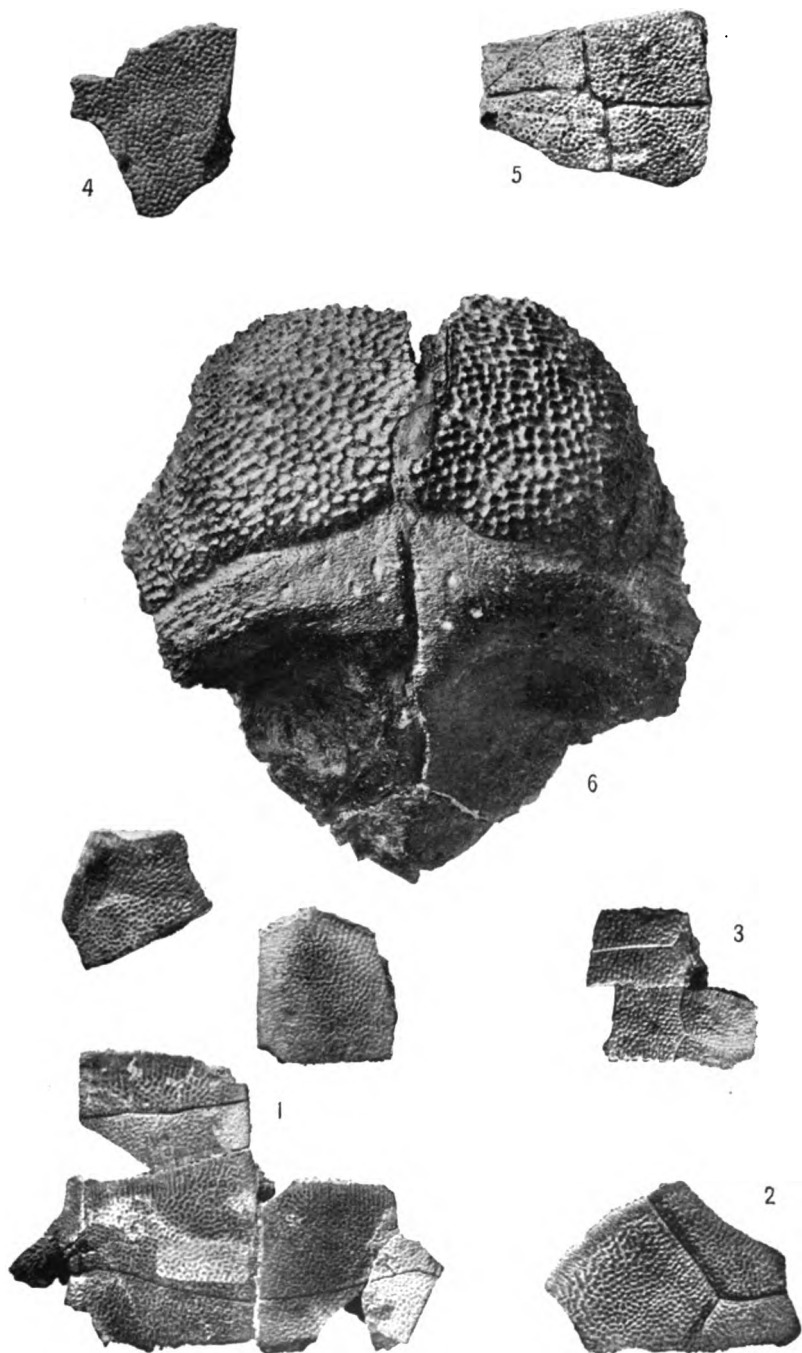
4. *Aspideretes amnigenus* $\times 1$. Left second costal plate. Some portions missing.

PLATE 12.

Hoplochelys bicarinata $\times \frac{1}{3}$.

Fig. 1. Part of one neural and parts of six costals.

2. Most of the plastron and various peripherals.



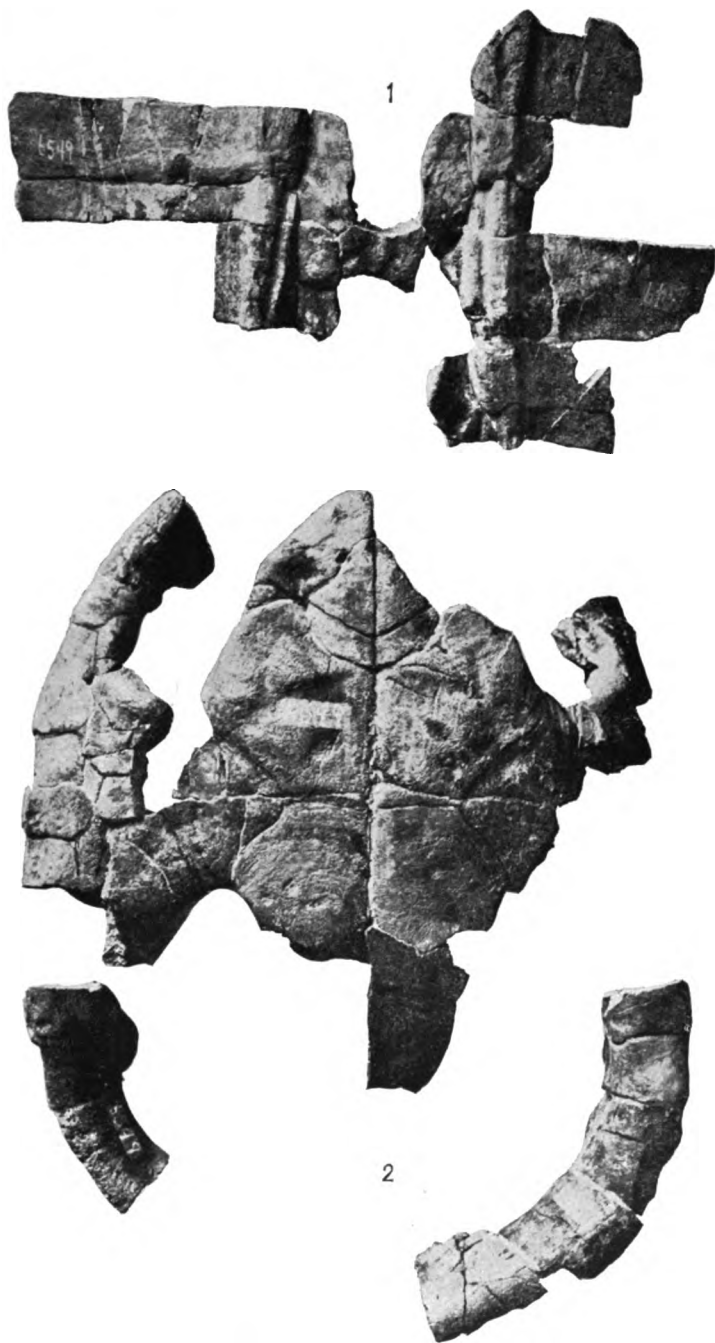
COMPSEMYS AND BASILEMYS.

FOR EXPLANATION OF PLATE SEE PAGE 326.



COMPSEMYS, ADOCUS, AND ASPIDERETES.

FOR EXPLANATION OF PLATE SEE PAGE 326.



HOPLOCHELYS BICARINATA.

FOR EXPLANATION OF PLATE SEE PAGE 326.

A COMPARISON OF THE CHUB-MACKERELS OF THE ATLANTIC AND PACIFIC OCEANS.

By BARTON WARREN EVERMANN
and
WILLIAM CONVERSE KENDALL,
Of the U. S. Bureau of Fisheries.

For a number of years the chub-mackerels, otherwise more or less locally known as Thimble-eye, Bulls-eye, and Hard-head mackerel, of both the Atlantic and Pacific oceans have been considered as one species of almost cosmopolitan distribution, bearing the name *Scomber colias* Gmelin (1788). More recently Doctor Jordan has assigned to them the earlier name, *Scomber japonicus*, under which the Japanese fish was described by Hutton (1782).

Recently we have had an opportunity to compare two specimens of chub-mackerel from Peru with several from Rhode Island, and find certain conspicuous differences. Further evidence was obtained by comparison of a number of specimens from several localities in both the Atlantic and Pacific, which showed the same differences as well as others of slighter importance. The most pronounced difference is in the size of the head which is proportionately longer in the Pacific form. The minor differences are in the positions of the dorsal and ventral fins. In the Atlantic form the first or spinous dorsal is inserted nearer the tip of the snout, and there is a greater distance between its origin and the origin of the second dorsal than in the Pacific fish. In the Atlantic fish, too, the distance between the tip of the lower jaw and the base of the ventral is shorter than in the Pacific specimens.

These differences are shown in the tables that follow.

Comparative measurements of Atlantic and Pacific chub-mackerels.

ATLANTIC SPECIMENS.

Locality.	Total length in inches.	Head in length without caudal fin.	Distance from tip of snout to origin of first dorsal in length without caudal.	Distance from origin first dorsal to origin second dorsal in length without caudal.	Distance from tip of lower jaw to base of ventral in length without caudal.
Point Judith, Rhode Island.....	8 $\frac{1}{2}$	3.72	2.80	2.97	3.02
Do.....	9 $\frac{1}{2}$	3.78	2.80	3.08	3.11
Do.....	9 $\frac{1}{2}$	3.72	2.84	3.11	3.07
Do.....	9 $\frac{1}{2}$	3.89	2.84	3.17	3.22
Vineyard Sound.....	12 $\frac{1}{2}$	3.72	2.77	3.11	3.09
Fulton Market.....	12 $\frac{1}{2}$	3.70	2.76	3.02	3.02
Genoa, Italy.....	12 $\frac{1}{2}$	3.78	2.86	2.95	3.08
Venice, Italy.....	11	3.65	2.72	3.12	2.96

PACIFIC SPECIMENS.

Hakodate, Japan.....	8	3.23	2.63	3.26	2.85
Do.....	8 $\frac{1}{2}$	3.41	2.64	3.22	2.90
Do.....	7	3.37	2.75	3.26	2.88
Awa, Japan.....	8 $\frac{1}{2}$	3.29	2.61	3.29	2.71
Luzon, Philippine Islands.....	5 $\frac{1}{2}$	3.21	2.60	3.21	2.78
Panama.....	5 $\frac{1}{2}$	3.23	2.74	3.23	2.80
Santa Barbara, California.....	9 $\frac{1}{2}$	3.41	2.67	3.21	2.84
Peru, South America.....	9 $\frac{1}{2}$	3.14	2.55	3.41	2.61
Do.....	10 $\frac{1}{2}$	3.22	2.57	3.33	2.66
Do.....	14	3.24	2.48	3.39	2.64
Do.....	14 $\frac{1}{2}$	3.16	2.44	3.14	2.75

Average proportional measurements of Atlantic and Pacific specimens.

Locality.	Total length in inches.	Head in length without caudal fin.	Distance from tip of snout to origin of first dorsal in length without caudal.	Distance from origin first dorsal to origin second dorsal in length without caudal.	Distance from tip of lower jaw to base of ventral in length without caudal.
Atlantic.....	10 $\frac{1}{2}$	3.74	2.79	3.06	3.07
Pacific.....	9 $\frac{1}{2}$	3.26	2.60	3.27	2.76

Proportional measurements of specimens of about the same length from both oceans.

Locality.	Total length in inches.	Head in length without caudal fin.	Distance from tip of snout to origin of first dorsal in length without caudal.	Distance from origin first dorsal to origin second dorsal in length without caudal.	Distance from tip of lower jaw to base of ventral in length without caudal.
Point Judith, Rhode Island.....	9 $\frac{1}{2}$	3.72	2.84	3.11	3.07
Peru, South America.....	9 $\frac{1}{2}$	3.14	2.55	3.41	2.61
Genoa, Italy.....	12 $\frac{1}{2}$	3.78	2.86	2.95	3.08
Peru, South America.....	14	3.24	2.48	3.39	2.61

These figures show a well-marked difference between the Atlantic and Pacific chub-mackerels that is of specific value, and the Atlantic form should, therefore, retain the name *Scomber colias* Gmelin and the Pacific form the name *Scomber japonicus* Hutton.

A NEW EUROPEAN CRINOID.

By AUSTIN HOBART CLARK,

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The careful and painstaking work of the late Dr. Oswald Seeliger upon the embryogeny of *Antedon* carried on at Trieste gave results which were, in many important particulars, different from those attained by Prof. Jules Barrois at Villafranca and by Mr. H. Bury at Naples.

Seeliger finds the diameter of the eggs to be 0.25 mm., while Bury gives it as 0.30 mm. It will be remembered that Wyville Thomson found the eggs of *Antedon bifida* to measure 0.50 mm. in diameter. Seeliger noticed that the segmentation from the third cleavage furrow onward was unequal, resulting in the formation of a blastosphere with markedly larger cells at the vegetative than at the animal pole, but Bury and Barrois found the cells of the blastosphere to be similar throughout. Gastrulation occurred, according to Seeliger, scarcely seven hours after the appearance of the first cleavage furrow; but Barrois and Bury first noticed it from twenty to twenty-four hours after fertilization. Seeliger reports that the blastopore is closed at the latest thirty-six hours after the first cleavage, but Bury records that this change takes place about forty hours after. Bury, who was the first to find underbasals in *Antedon* (though their occurrence in the larvæ had been shown to be probable many years before by Wachsmuth and Springer), gives the usual number as three; Seeliger, on the other hand, reports it as four or five.

Now from an embryological point of view these differences are fundamental, and are far greater than would reasonably be expected within the limits of a single species. All three workers referred their specimens to *Antedon rosacea*, which, as understood by them, ranged from Norway southward to and throughout the Mediterranean; but they all suspected that this specific determination was unsatisfactory, though none of them attempted to investigate the question. The *Challenger* report upon the comatulids had just been published, and this was naturally taken as their systematic basis.

In the preparation of a monograph upon the recent crinoids I have been enabled, thanks to the kindness of very many fellow-workers,

to examine some hundreds of *Antedons* representing all the localities inhabited by the genus, and I find that there are four perfectly distinct and readily recognizable species, two inhabiting the Atlantic coasts of Europe and two the southern shores east of the Straits of Gibraltar. For the two first the names *Alecto petasus* Düben and Koren, 1846, and *Asterias bifida* Pennant, 1777, are available, while one of the two last should bear the title of (*Comatula*) *mediterranea* Lamarck, 1816. The fourth species, which so long ago as 1792 Olivi found to be abundant in the Adriatic Sea, has never been recognized by systematists, but has always been considered the same as the preceding, which, in turn, has usually been confused with the *bifida* of Pennant and often, in addition, with the *petasus* of Düben and Koren.

These four species, far from being so closely related that only an extremist can distinguish them, may be at once recognized at sight by anyone who will take the trouble to make himself familiar with their characters; the two Mediterranean forms have very long and slender arms, and long slender cirri with numerous segments, while the Atlantic species have much shorter and stouter arms and cirri, the latter with fewer segments. *Antedon petasus* differs from *A. bifida* chiefly and most obviously in the very much greater number of its cirri, while the two Mediterranean forms are most readily differentiated by the proportionate length of the cirri and by the numbers of their component segments.

A review of the facts presented by the study of comatulid ontogeny shows that *Antedon bifida*, and especially *A. petasus*, represent a phylogenetically more advanced condition than the comparatively primitive Mediterranean forms, and that of these latter the Adriatic species is less developed than the one found from Italy westward. Now the Adriatic form usually has four or five underbasals, and the one occurring at Naples, Toulon, and Villafranca three. No underbasals have ever been found in *Antedon bifida*, but this is not at all remarkable, nor does it reflect upon the powers of observation of the able naturalists who have studied it; for if the comparatively slight specialization of *Antedon mediterranea* over the Adriatic species is sufficient to result in the reduction of the number of underbasals from four or five to three, we may readily infer that the much greater degree of specialization of *A. bifida* over *A. mediterranea* would result in the elimination of underbasals entirely from the ontogeny of the former. I can see no reason whatever for doubting the accuracy of the work of Wyville Thomson, Perrier, and the two Carpenters, who, none of them, found underbasals in *Antedon bifida*, and I should be greatly surprised if anyone in the future should find them in that species or in *A. petasus*, except, perhaps, in sporadic instances.

The anal plate is the only interradian which has been observed in the two Mediterranean species of the genus *Antedon*; but Wyville Thomson observed "in one or two cases * * * about the time of the first appearance of the anal plate a series of five minute rounded plates developed interradianly between the lower edges of the anal plates and the upper edge of the basals." The appearance of five interradianals in *Antedon bifida* is exceedingly interesting, for it shows an approach to the conditions found in the highly specialized family Comasteridæ, in which they are always, so far as known, highly developed in the young,^a and to the conditions found in the equally specialized family Pentametrocrinidæ, in which they were described in the young of one of the species of *Pentametrocrinus* ("*Thaumatocrinus*").

I have recently shown that *Antedon* is primarily an Indian Ocean genus, an intrusion into the Atlantic area, like *Leptometra*. The area inhabited by it is marked by a series of species each phylogenetically more developed than its predecessor, and the least specialized more advanced than the species of *Mastigometra*, its modern representative in the Indian Ocean.

The hitherto undescribed *Antedon* from the Adriatic Sea may be appropriately known as:

ANTEDON ADRIATICA, new species.

Centrodorsal flattened hemispherical, about 4 mm. in diameter at the base, the bare dorsal pole flat, about 1.5 mm. in diameter; cirrus sockets arranged approximately in three closely crowded alternating rows, the uppermost of which includes about four sockets in each radial area.

Cirri XXV-XL (usually XXX-XXXV) 22-30 (usually 24-28), 20 mm. to 27 mm. long, slender, and of uniform thickness throughout their length; first segment very short, the second about half again as broad as long, the third about as long as broad, the fourth half again as long as the width of its expanded ends; fifth and following about twice as long as the width of the distal ends, and remaining of practically the same proportions to the end of the cirrus, though the distal segments may be a trifle shorter than those nearer the base; penultimate segment nearly or quite twice as long as broad, and bearing a prominent slender and sharp opposing spine which is subterminal in position, directed slightly forward or nearly erect, and equal to about one-half the distal diameter of the penultimate segment in height. Terminal claw slender, evenly tapering, and moderately and uniformly curved, about equal to the penultimate segment

^aThey have been described in the young of *Comatilia*, and they are equally well developed in the pentacrinoids of *Comactinia meridionalis*.

in length. The fourth and following segments are moderately constricted centrally, so that the ends are prominent; this character slowly diminishes in the distal half of the cirri. The cirri are nearly round in basal section, but gradually become slightly compressed laterally and are moderately compressed in the distal portion; this lateral compression is very gradual, and is not attended with an increase in the lateral diameter of the cirrus as in *Antedon bifida*. In a lateral view the dorsal profile of the segments is seen to be slightly more concave than the ventral, especially distally, making the proximal and distal dorsal ends of the segments somewhat prominent.

Disk resembling that of *Antedon mediterranea*, usually naked, but sometimes with a more or less abundance of calcareous spicules in the inner part of the interpalmar areas; sacculi abundant along the ambulacra, but small and irregularly arranged in one, two, or three rows, becoming more definitely arranged in a single row along the brachial ambulacra.

Radials even with, or extending very slightly beyond, the edge of the centrodorsal, rising in the interradial angles of the calyx into a low triangle; I Br₁ oblong or slightly trapezoidal, two and a half to three times as broad as long, the lateral edges slightly produced and swollen; a shallow groove usually borders this swollen edge interiorly, which may be reduced to a small round pit just proximal to the median horizontal diameter of the ossicle. I Br₂ (axillary) roughly a right-angled triangle, the apex rather sharp; lateral edges, which are about half the length of those of the I Br₁, somewhat swollen and produced.

Ten slender arms 100 mm. to 110 mm. long; first brachial wedge-shaped, twice as long exteriorly as interiorly, about half again as broad as the exterior length, interiorly just in contact basally; the exterior margin is swollen and slightly produced; second brachial irregularly quadrate, larger than the first, though of about the same length exteriorly; synarthrial tubercles sometimes slightly prominent, but usually not marked; third and fourth brachials (syzygial pair) slightly longer interiorly than exteriorly, about half again as broad as long in the median line; fifth brachial slightly wedge-shaped, about twice as broad as long in the median line, the following becoming more obliquely wedge-shaped, and after the second syzygy triangular, about as long as broad, soon becoming somewhat less oblique and wedge-shaped again and very slowly increasing in length, being very long terminally. Syzygies occur between the third and fourth brachials, again between the ninth and tenth and fourteenth and fifteenth, and distally at intervals of three oblique muscular articulations.

P₁ 11 mm. to 13 mm. long with seventeen or eighteen segments, the first about as long as broad, the remainder about twice as long as broad, becoming somewhat longer distally; the pinnule is much

stouter than those succeeding, and tapers very gradually to the tip; it is not so slender distally as in *A. bifida*; the third and following segments have the distal outer edge produced and finely spinous, this increasing gradually in intensity and becoming prominent in the outer half of the pinnule. P_2 7 mm. to 8 mm. long with twelve segments, the first about twice as broad as long, the second squarish, the remainder about twice as long as broad, becoming terminally about three times as long as broad; the third and following develop projecting and spinous distal outer edges which are quite prominent; P_3 and following pinnules similar to P_2 ; the distal pinnules are 10 mm. to 12 mm. long, exceedingly slender, with twenty segments, the first longer than broad, the remainder greatly elongated with swollen articulations.

Type-specimen.—Cat. No. 24313, U.S.N.M., from Trieste.

Ninety-six additional specimens from Trieste were examined.

Cotypes are in the Copenhagen Museum, Copenhagen, Denmark; the Zoological Museum at Berlin, Germany, and in the Museum of Comparative Zoology at Cambridge, Massachusetts.

ON SOME OSTRACODA, MOSTLY NEW, IN THE COLLECTION OF THE UNITED STATES NATIONAL MUSEUM.

By RICHARD W. SHARPE,

Department of Biology, Dewitt Clinton High School, New York City.

The Ostracoda herein recorded are from collections made in the Mississippi Valley in the States of Illinois, Wisconsin, and Nebraska, from Massachusetts, and from Barbados, British West Indies.

The specimens from Wisconsin were originally sent to the U. S. National Museum for identification by Miss Effie J. Rigden, of the University of Wisconsin. They were collected from aquaria at the university greenhouse, and the suspicion naturally arises that they were introduced with some exotic water plants.

The specimens from Nebraska were kindly sent to the writer for identification and study by his friend, Prof. A. S. Pearse, of the University of Michigan. Those from Barbados were recently sent to the National Museum by the Imperial Department of Agriculture for the West Indies, and were collected by the entomologist of the department, Mr. Henry A. Ballou, on May 1, 1909.

Genus CYPRIIS O. F. Müller, 1792.

Subgenus CYPRIIS O. F. Müller, 1792.

CYPRIIS (CYPRIIS) GLOBULOSA, new species.

Dimensions.—Length of female, 0.77 mm.; breadth, 0.58 mm.; height, 0.52 mm. Male, unknown.

Characters.—An unusually small member of this genus, very much resembling *Cypridopsis*-like forms, not alone in size, but in shape. Indeed, the individuals are so plump that instead of lying on their side, as is so common among Ostracods, they usually remain dorsal or ventral side up. The shells of preserved specimens show no especial markings of any sort.

Seen from the side (fig. 1a) the shell is two-thirds as high as long, with the highest point in the middle; dorsal margin slightly humped; ventral margin sinuate in the middle. Seen from above (fig. 1b) the shell is broadly egg-shaped, but pointed anteriorly, where the right shell overlaps the left; shell sparsely hairy, with the greatest

breadth just posterior to the middle; natatory setæ of the second antennæ reaching well beyond tips of terminal claws; the two spines of the first maxillary process stout and toothed; terminal segment of second foot beak-shaped (fig. 1*d*), and bearing a large hook-shaped spine, and a seta which is about two and a half times the length of the spine; terminal claw of first foot about as long as rest of foot; caudal ramus smooth (fig. 1*c*), long and slender, and about eighteen times as long as wide; terminal claw very long and seta-like, fully three-fourths as long as the ramus; subterminal claw about one-half as long as terminal one, and also very slender and seta-like; terminal seta weak, scarcely evident; dorsal seta about one-third length of subterminal claw, and situated about the width of the ramus from it.

Remarks.—A number of specimens of this interesting *Cypris* were sent to the U. S. National Museum for identification by Miss Effie J.

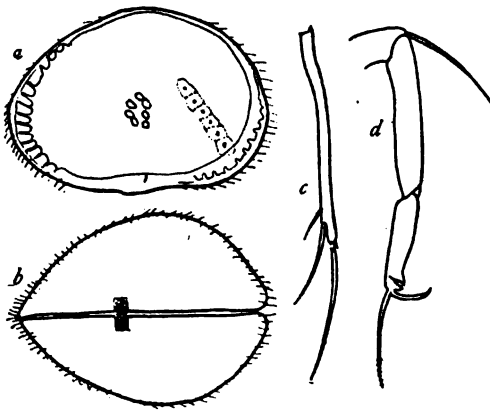


FIG. 1.—CYPRIS (CYPRIS) GLOBULUS. *a*, RIGHT SHELL FROM WITHIN, $\times 70$; *b*, DORSAL VIEW, $\times 70$; *c*, FURCA, $\times 210$; *d*, SECOND FOOT, $\times 210$.

Rigden, of the University of Wisconsin. She had been studying their light reactions. Speaking of their habitat she says: "The Ostracods whose habitat you wish to know were taken from a tub in the greenhouse at the University of Wisconsin. They have been living there all winter. I have not found them elsewhere. The tub is kept filled with fresh water, and contains several water plants, and a great deal of *Vaucheria*, in which

the Ostracods are generally found. I have been able to keep them for weeks in a jar in which I have placed some of the *Vaucheria*."

Type-locality.—Madison, Wisconsin.

Type-specimen.—Cat. No. 39514, U.S.N.M.

Subgenus CYPRINOTUS Brady, 1886.

CYPRIS (CYPRINOTUS) DENTATA, new species.

Dimensions.—Length, 1.3 to 1.4 mm.; height, 0.5 to 0.65 mm.; breadth, 0.5 to 0.58 mm.

Characters.—Preserved specimens show no especial shell markings, and are yellowish, transparent, and smooth.

Seen from the side (fig. 2*a*) the shell margins are nearly parallel, the posterior extremity being more acutely pointed than the anterior. Right valve (fig. 2*c*), somewhat smaller than the left, its entire mar-

gin, except a small portion at the middle, being armed with a row of about sixty tuberculiform teeth, which are more prominently shown postero-ventrally; left valve with smooth margins (fig. 2*b*); ventral margin slightly flanged at the middle, and with a much nar-

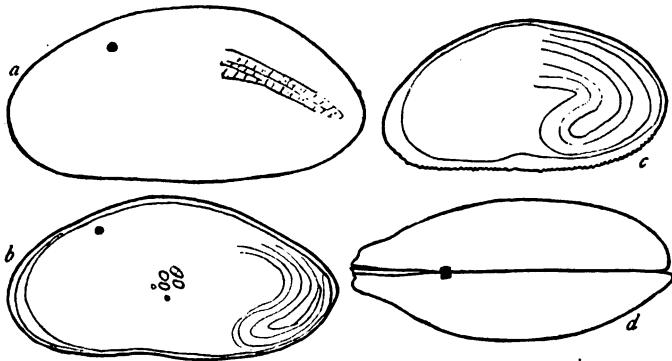


FIG. 2.—CYPRIS (CYPRINOTUS) DENTATA. *a*, LEFT SHELL OF FEMALE, $\times 60$; *b*, LEFT SHELL OF MALE, $\times 60$; *c*, RIGHT SHELL OF MALE, $\times 60$; *d*, DORSAL VIEW OF MALE, $\times 60$.

rower growing line than the right; viewed dorsally (fig. 2*d*) the left valve overlaps the right both anteriorly and posteriorly—abruptly narrowed anteriorly but yet rather blunt at the extreme tip; spines of the first maxillary process strong, blunt, and toothed; natatory setæ of the second antennæ simple, the longer reaching well beyond tips of the terminal claws; terminal claw of the second leg (fig. 3*b*) slender, decidedly curved, slightly longer than the width of terminal segment, and faintly toothed; maxillary palps of the male stout and decidedly hooked, as in figures 3 *c*, *d*; ductus in sac, and of about twenty-six whorls of spines; penis (fig. 3*e*) triangular, and with a boot-shaped branch; furca (fig. 3*a*) about sixteen times as long as wide, slightly curved, and about twice as long as the terminal claw; both claws nearly smooth, slightly curved, the shorter two-thirds the length of the longer, and situated about the width of the ramus from it; terminal seta slender, about four-fifths length of dorsal one, which is situated about width of ramus from subterminal claw, and is one-half its length.



FIG. 3.—CYPRIS (CYPRINOTUS) DENTATA, *a*, FURCA, $\times 105$; *b*, SECOND LEG, $\times 250$; *c*, MAXILLARY PALP OF MALE, $\times 130$; *d*, MAXILLARY PALP OF MALE, $\times 130$; *e*, PENIS.

Remarks.—The specimens were collected by Prof. A. S. Pearse, of the University of Michigan, in a small pond near Stamford, Nebraska,

on August 2, 1902, and later kindly sent to the writer for study and identification.

Type-locality.—Fresh-water pools near Stamford, Nebraska.

Type-specimen.—Cat. No. 39513, U.S.N.M.

Genus *CYPRIA* Zenker, 1854.

CYPRIA OBESA Sharpe.

Cypria obesa SHARPE, Bull. Ill. State Lab. Nat. Hist., vol. 4, art. 15, 1897, p. 462, pl. 48, figs. 1-5.

Dimensions.—Average length 0.58 mm.; average height 0.3 mm. Fresh-water representatives of this species slightly larger.

Remarks.—The color of brackish water forms varies from a light transparent brown to a reddish brown. The reddish tint may be due to the fact that they are closely associated with, and feed upon, a red-

dish alga common in the localities in which this smaller reddish variety is found. Penis as in fig. 4d. In all other respects, excepting size and color this form agrees perfectly with *C. obesa*. I am therefore designating it by this name, rather than adding a varietal name, as it is well known that most

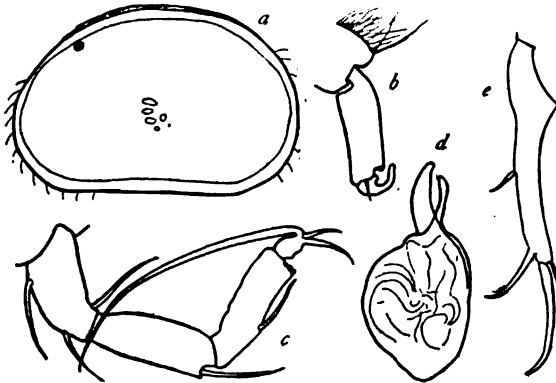


FIG. 4.—*CYPRIA OBESA*. a, RIGHT SHELL FROM WITHIN, $\times 70$; b, LEFT MAXILLARY PALP OF MALE; c, SECOND FOOT, $\times 210$; d, PENIS, $\times 250$; e, FURCA, $\times 250$.

Entomostraca vary in accordance with the seasons and differences in character of habitat.

Remarks.—This is the only Ostracod of the brackish ponds in the vicinity of Woods Hole, Massachusetts, which is also found in fresh water. It occurs abundantly, and is associated with the reddish algæ of such ponds during July and August.

Brady^a speaks of other members of this genus as being found in the brackish waters of the British coasts. He also mentions *Cyclo-cypriis* (*Cypria*) *lævis* as common "in fresh and brackish waters." As *C. lævis* is to be found in all sorts of stagnant and foul waters, it is not surprising that it should be found in waters that are quite brackish.

^a Brady and Norman, Monogr. of marine and fresh-water Ostracoda, Sci. Trans. Roy. Dublin Soc., vol. 4, 1889. p. 69.

Occurrence.—Found abundantly in all the brackish ponds in the vicinity of Woods Hole, and at Naushon Island, Massachusetts, during July and August.

Distribution.—Small sandy lakes, Havana, Illinois, May to August, (Sharpe). Ponds at Jackson Park, Chicago, May.

Genus *CHLAMYDOTHECA* Saussure, 1838.

CHLAMYDOTHECA BARBADENSIS, new species.

Dimensions.—Male, length 3.4 mm., height 1.6 mm.; female, length 3.8 mm., height 1.8 mm.

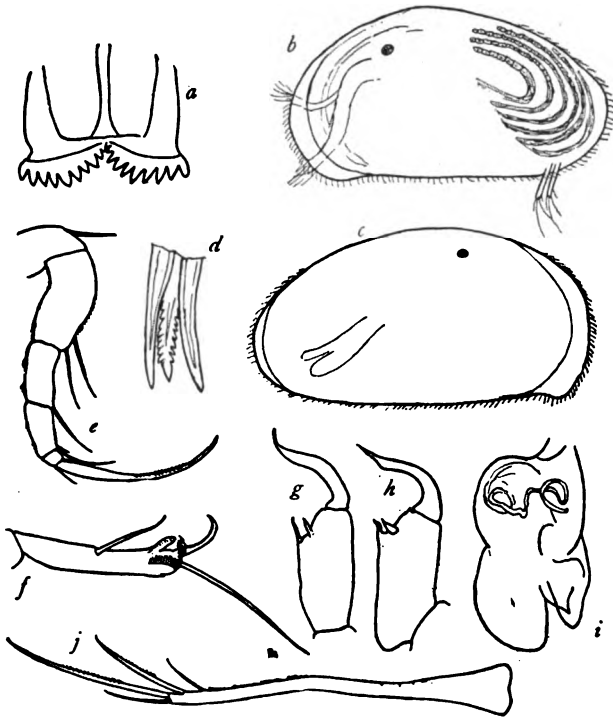


FIG. 5.—*CHLAMYDOTHECA BARBADENSIS*. *a*, RAKE-LIKE ORGANS OF MOUTH, $\times 140$; *b*, LEFT SHELL OF MALE, $\times 20$; *c*, RIGHT SHELL OF FEMALE, $\times 20$; *d*, SPINES OF FIRST MAXILLARY PROCESS, $\times 120$; *e*, FIRST LEG, $\times 70$; *f*, TERMINAL SEGMENT OF SECOND LEG, $\times 70$; *g*, *h*, MAXILLARY PALPS OF MALE, $\times 80$; *i*, PENIS, $\times 60$; *j*, FURCA, $\times 60$.

Characters.—Viewed laterally (fig. 5*b*) the shell of the male is about three-fifths as high as long. The greatest height is in the anterior third, just back of the eye spot, from which the dorsal margin slopes rapidly posteriorly; ventral margin nearly straight; shells of alcoholic specimens with no especial indications of color markings, and quite pellucid, showing the internal organs quite plainly; shells of both male and female showing the anterior flanges so characteristic of the genus; shell of the female (fig. 5*c*) not quite so

arched dorsally, and somewhat larger, otherwise much as the male; natatory setæ of the second antennæ plumose, reaching almost to tips of terminal claws; the three spines of the first maxillary process (fig. 5*d*) strong, the middle one toothed; the two setæ on the second segment of the first leg almost equal in length (fig. 5*e*); terminal claw strong, about three-fourths as long as the last four segments taken together and coarsely toothed on its distal half; second foot terminating in the usual beak-shaped segment (fig. 5*f*); palps of the second maxillæ of the male as in fig. 5*g*, *h*; penis as in fig. 5*i*; furca (fig. 5*j*) about twenty-two times as long as wide, decidedly bent at about the middle, plainly toothed its distal dorsal half, more faintly the rest of the way, the spines of the distal half showing a tendency to be arranged comb-like, as shown in the figure; terminal claw nearly straight, about one-half the length of the furca, and toothed in its distal half; subterminal claw less than one-half the length of the terminal claw, and plainly toothed its distal half; terminal seta about same length as the dorsal seta, which is about six-elevenths the length of the subterminal claw.

This new species is described from two specimens, two males and two females, "taken from a small pond on Government Hill, Barbados, May 1; they are common in pools of water, more or less permanent, and reappear in ponds that have been dry for weeks at a time, as soon as the rain fills them up again." Sent to the U. S. National Museum by the Imperial Department of Agriculture for the West Indies (H. A. Ballou, collector, May 1, 1909).

Type-specimen.—Cat. No. 40524, U.S.N.M.

Remarks.—Since males were found in this collection, a circumstance not heretofore recorded to my knowledge, the generic description is hereby revised in that particular.

But few species of this genus have ever been described. The following are all that are known to the author in addition to the above:

C. azteca Saussure, Texas.

C. (Cypris) braziliensis (Dana), Brazil.

C. (Cypris) herricki (Turner), Ohio.

C. (Pachycypris) incisa (Claus), Argentina.

C. (Pachycypris) leuckarti (Claus), Argentina and Venezuela.

C. mexicana Sharpe, Mexico.

C. (Herpetocypris) obliqua (Daday), Patagonia.

C. (Cypris) speciosa (Dana), Rio de Janeiro. (Collected by Charles Darwin.)

C. subglobosa (Sowerby), Ceylon.

C. symmetrica Vavra, Falkland Islands and Straits of Magellan region.

It is interesting to note that all but one of these species are to be found in the Western Continent, and of these the majority are from South America.

C. barbadensis differs from all other species of the genus known to the writer in the following particulars: First, none other is known to be sexual; second, the quite pellucid shells of alcoholic specimens; third, the greater or less tendency of the dorsal spinules of the furca toward a comb-like arrangement (fig. 5j); fourth, it is the largest of any reported except *C. obliqua*, from Patagonia.

DESCRIPTIONS OF SOME NEW SPECIES OF MONKEYS OF
THE GENERA PITHECUS AND PYGATHRIX COLLECTED
BY DR. W. L. ABBOTT AND PRESENTED TO THE UNITED
STATES NATIONAL MUSEUM.

By D. G. ELLIOT.

The examples upon which the following species were based were procured, with the exception of the type of *Pygathrix ultima*, by Dr. W. L. Abbott from the islands of the Eastern Archipelago.

Genus PITHECUS.

PITHECUS LAPSUS, new species.

Macaca phæura (not MILLER) LYON, Proc. U. S. Nat. Mus., vol. 31, 1906, p. 606.

Type-locality.—Island of Banka, east of southern Sumatra.

Type.—Cat. No. 124863, U.S.N.M.

Geographical distribution.—Islands of Banka and Billiton.

General characteristics.—Similar to *P. phæura*, but much darker; rostrum shorter and narrower, premaxillæ lengthened, protruding.

Color.—Frontal streak black, conspicuous, broader than in *P. phæura*; top of head, upper parts of body, and outer side of arms and thighs covered with hairs, pale drab at base and annulated on apical half with black and tawny ochraceous; legs below knees gray, hairs tipped with buff; cheeks, underparts and inner side of limbs buffy smoke gray; hands similar to outer side of arms; feet yellowish gray; tail blackish at base above, grading into gray at tip, beneath smoke gray.

Measurements.—Total length, 955 mm.; tail, 520; (Coll.) foot, 124; (skin); skull, total length, 113.8; occipito-nasal length, 94.7; hensel, 80.2; zygomatic width, 76.2; intertemporal width, 37.5; palatal length, 43.7; median length of nasals, 22.7; length of upper molar series, 28; length of mandible, 83; length of lower molar series, 36.3.

The color of this species is very different from *P. phæura* Miller, is much darker generally and not so yellow in tone, while the feet are yellowish gray, quite different from the dark feet of its ally. The skull also shows important differences, while the geographical distribution of the two forms would seem to negative the idea that they were the same species.

PITHECUS AGNATUS, new species.

Type-locality.—Pulo Tuangku, Banjak Islands.

Type.—Cat. No. 114409, U.S.N.M.

General characteristics.—Nearest to *P. phæura*, but paler; hands, feet, and tail lighter.

Color.—Black bar on forehead, rather indistinct; top of head, hind-neck and upper parts with the hairs gray at base, then banded with ochraceous and black and tipped with black, giving a general ochraceous hue with a sienna tinge, without any of the tawny shade seen in *P. phæura*; arms and hands gray, hairs tipped with cream buff; outer side of thighs like back; legs and feet smoke gray; underparts and inner side of limbs yellowish white; tail above, black at roots, hairs tipped with ochraceous, grading into pale smoke gray on apical half, beneath pale gray; a band of russet crosses beneath the chin.

Measurements.—Total length, 953 mm., tail, 530; skull, total length, 107; occipito-nasal length, 88.4; hensel, 75.9; intertemporal width, 39.3; zygomatic width, 74.1; palatal length, 45.6; median length of nasals, 28.1; length of upper molar series, 28.5; length of mandible, 78.2; length of lower molar series, 35.3.

This macaque is allied to *P. phæura*, but differs in its general paler coloration, and lighter hands, feet, and tail. Four examples were obtained by Doctor Abbott at Tuangku Island.

PITHECUS LINGUNGENSIS, new species.

Type-locality.—Pulo Lingung, Natuna Islands.

Type.—Cat. No. 104853, U.S.N.M.

General characteristics.—Tooth row long; general color of fur reddish.

Color.—Top of head and upper parts rich tawny and black, base of hairs grayish; outer side of limbs, hands and feet gray; hairs banded and tipped with cream buff; underparts and inner side of limbs yellowish white; tail above at root like back, remainder brownish black, hairs barred with cream buff, beneath smoke gray.

Measurements.—Total length, 847 mm.; tail, 574; skull, total length, 108.8; occipito-nasal length, 91.8; hensel, 75; intertemporal width, 87.9; palatal length, 45.8; median length of nasals, 27; length of upper molar series, 30.4; length of mandible, 78.5; length of lower molar series, 37.7.

The general appearance of this macaque is totally unlike *P. sirhasenensis* on the south, and while the skulls of the two forms have a general resemblance to each other, the present species has a narrower brain case, longer tooth rows, and smaller incisors, these last being intermediate between the species just named and *P. lautensis*. One specimen only was obtained by Doctor Abbott.

PITHECUS LAUTENSIS, new species.

Type-locality.—Pulo Laut, Natuna Islands.

Type.—No. 104854, U.S.N.M.

General characteristics.—Resembling *P. lungungensis*, but not so red; skull entirely different.

Color.—Top of head and upper parts tawny ochraceous and brownish black; arms and hands bluish gray, hairs tipped with cream buff; outer side of thighs similar to back; legs olive gray; feet darker, being brownish gray; underparts and inner side of limbs silvery gray; tail above blackish brown, becoming gradually paler toward tip, beneath whitish gray.

Measurements.—Total length, 1,018 mm.; tail, 548; skull, total length, 112.2; occipito-nasal length, 95.3; hensel, 80.7; intertemporal width, 39.8; zygomatic width, 82.7; palatal length, 45.7; breadth of brain case, 54.5; median length of nasals, 27.1; length of upper molar series, 27.1; length of mandible, 84.1; length of lower molar series, 36.1.

This macaque is very similar in color on body and head to *P. lungungensis*, but is very different in the color of the limbs, arms particularly. The main differences are to be found in the skull. This has a very broad facial region and space across orbits very wide; orbital ridge very heavy; the brain case is larger in every way, and the roots of the zygomata broader and heavier; palate is wider; basi-occipital and basi-sphenoid broader and longer and the zygomatic arch more widely spread. The outer edge of the occipital region in *P. lungungensis* is rounded, but in the present species it is pyramidal without the point. Incisors are smaller. Altogether the two skulls are as different as they well can be of species belonging to the same genus. One example only procured.

PITHECUS SIRHASSENENSIS, new species.

Type-locality.—Sirhassen Island, Natuna Group.

Type.—Cat. No. 104852, U.S.N.M.

General characteristics.—General hue very dark, limbs and feet paler; skull in general characters nearest to *P. lungungensis*, but tooth rows much shorter.

Color.—Top of head, upper parts of body, and outer side of thighs blackish brown and ochraceous, the hairs gray at base, then banded with ochraceous and black and tipped with black; limbs, hands, and feet pale gray, hairs banded with cream buff; underparts and inner side of limbs grayish white; tail above at base, blackish, hairs ringed with ochraceous grading into smoke gray for remaining part; beneath smoke gray.

Measurements.—Total length 1,110 mm.; tail, 600; skull, total length, 113.3; breadth of brain case, 54; intertemporal width, 40.5;

palatal length, 47; median length of nasals, 27; length of upper molar series, 27.6; length of mandible, 77.7; length of lower molar series, 35.5.

This species is very dark in color, differing greatly from the other macaques of this group of islands. The skull agrees more nearly with that of *P. lingungensis*, but the tooth row is much shorter, the palate wider, and the brain case broader.

PITHECUS VITIUS, new species.

Type-locality.—Domel Island, Mergui Archipelago.

Type.—Cat. No. 124176, U.S.N.M.

Geographic distribution.—Domel, St. Matthew, and Sullivan islands, Mergui Archipelago.

General characteristics.—Hair long, loose, hands and feet yellowish gray.

Color.—Top of head and upper parts wood brown, darkest over dorsal line and lighter on sides, the hairs being gray at base, and banded with black and yellow over apical half; arms and hands similar to back; thighs like back, legs pale yellowish brown; feet slightly darker; underparts and inner side of limbs yellowish gray; tail above blackish brown, at root like back, beneath yellowish brown.

Measurements.—Total length, 935 mm.; tail, 495; skull, total length, 116.6; occipito-nasal length, 99.7; hensen, 80.4; zygomatic width, 76.6; intertemporal width, 43.7; palatal length, 44.6; median length of nasals, 28.4; length of upper molar series, 34; length of mandible, 86; length of lower molar series, 39.5.

This is a gray hand and foot macaque quite different from the Javan gray-handed species *P. mordax* and *P. resimus*, as is to be expected. Specimens were obtained by Doctor Abbott, beside the type-locality, on St. Matthew and Sullivan islands of the same archipelago. One was a very old male in faded pelage, and another a female closely resembling the male described above.

PITHECUS CARIMATÆ, new species.

Type-locality.—Telok Pai, Karimata Islands.

Type.—Cat. No. 125101, U.S.N.M.

General characteristics.—Similar to *P. mandibularis* from Sungei Sama, near Pontianak, Borneo, but grayer and without the tawny hues of that species. Skull with the tooth rows straight, not curved; teeth larger and tooth rows longer; palate deeper, longer, and wider; incisors narrower in both jaws; orbits smaller; narial opening much larger; intertemporal breadth less; brain case shorter and narrower; mandible stouter, horizontal portions deeper.

Color.—Space around eyes bare, flesh color; superciliary stripe gray; above which is a narrow black bar across forehead; top of

head, neck, upper parts and outer side of thighs mottled blackish-brown and buff, with a grayish wash, the hairs being gray at base, which shows through, then annulated with buff and black, and black-tipped; flanks gray; outer side of arms and hands dark grayish, hairs ringed with whitish; legs uniformly gray; feet gray with brownish tinge; tail above black, tip smoke gray, beneath soiled white.

Measurements.—Total length, 1,115 mm.; tail, 655; foot, 144; skull, total length, 114; occipito-nasal length, 95.8; intertemporal width, 39.9; zygomatic width, 77.5; palatal length, 48.3; median length of nasals, 28.1; length of upper molar series, 30.1; length of mandible, 85.6; length of lower molar series, 37.2. This is a large macaque with a very long tail and of a generally grayish-brown color. It does not closely resemble any known species.

PITHECUS MANDIBULARIS, new species.

Type-locality.—Sungei Sama, near Pontianak, Borneo.

Type.—Cat. No. 142225, U.S.N.M.

General characteristics.—Similar in coloration to *P. fascicularis*, but paler, less red, and the ascending ramus of mandible narrower, higher, and with a backward inclination.

Color.—Upper parts ochraceous buff; the hairs being gray at base and then banded with black and ochraceous buff, the latter color dominating; top of head more tawny; whorl on cheeks and below ears gray; outer side of arms and hands gray, speckled with yellow; outer side of thighs like back; legs below knees and feet smoke gray, unspeckled; underparts and inner side of limbs whitish; tail above blackish, paler toward tip, beneath buffy gray.

Measurements.—Total length, 1,015 mm.; tail, 570; foot, 140; skull, total length, 112; occipito-nasal length, 95.9; zygomatic width, 77; intertemporal width, 41.7; palatal length, 45; median length of nasals, 26.9; length of upper molar series, 28; lengths of mandible, 80.9; length of lower molar series, 34.8; width of ascending ramus at middle, 22.3; at top, 23.3; extreme perpendicular height, 38.1.

The great difference in the shape of the ascending ramus persists in all the skulls, and when compared with that of *P. fascicularis* renders its narrowness and height conspicuous. The size of the ascending ramus of *P. carimatæ* is about halfway between those of the Bornean and Sumatran macaques, and in the color of its pelage it is quite unlike both.

PITHECUS BAWEANUS, new species.

Type-locality.—Bawean Island, Java Sea.

Type.—Cat. No. 151829, U.S.N.M.

General characteristics.—Larger than *P. cupidus*, the next species, from Mata Siri Island, and tail dark hair brown with an olive tinge. General hue more yellowish.

Color.—Nude yellowish spot above eyes; face covered with short gray hairs; short black bar above eyes; top of head and entire upper parts dark buff yellow and black; hair gray at base and then banded with buff yellow and black and tipped with black; outer side of arms and hands more grayish than upper parts, base of hairs being bluish gray and banded with cream buff and tipped with black; outer side of thighs like back; legs from knees to ankles, and feet gray, with cream-buff annulations less numerous and distinct than on arms; whorl on side of head below ears whitish gray with a cream-buff edging; throat, underparts and inner side of limbs, yellowish white; tail above, blackish brown at base, speckled with buff; remainder dark hair brown, beneath olive gray.

Measurements.—Total length, 1,052 mm.; tail, 580; foot, 141; skull, total length, 127; occipito-nasal length, 106.7; hensen, 90; intertemporal width, 41.3; zygomatic width, 88.9; palatal length, 51.9; median length of nasals, 22.3; length of upper molar series, 34.9; length of mandible, 89.1; length of lower molar series, 36.9.

This species differs from its nearest ally *P. cupidus*, by having the hands on hairs much paler, and a more olive tail. The skulls, however, are entirely dissimilar, that of the present species being much larger. The rostrum is broader and heavier, nasals wider, orbital ridges heavier and more elevated in center; low crest higher and shorter, the two lateral ridges not uniting until they reach the posterior portion of the frontal; occipital region has a more acute angle; bullæ more inflated; palate wider; tooth rows curved posteriorly, the last molar set inwards on both sides; incisors projecting at a more acute angle; zygomatic arch curved and with considerable spread. The skulls of these two macaques possess unusually numerous points of difference not often seen in allied species.

PITHECUS CUPIDUS, new species.

Type-locality.—Pulo Mata Siri, Java Sea, 44 miles from Pulo Laut.

Type.—Cat. No. 151831, U.S.N.M.

General characteristics.—Size moderate; hands and feet yellowish; tail longer than head and body; hair radiating fan-like from ears.

Color.—Space above eyes nude, flesh color, or yellowish; face covered with very short grayish-white hairs; cheeks and sides of head yellowish gray, hair long and radiating forward from ears, fan shape; top of head and entire upper parts, general tone ochraceous buff and black, the hairs gray at base and banded with ochraceous buff and black and tipped with black; flanks gray and with a yellow tinge; arms and hands, legs and feet cream buff and dusky, the hairs dusky at base, barred with cream buff and black, and tipped with the latter color; throat, chest and entire under parts of body, and inner side of limbs whitish; tail above brownish black for three-

fourths the length grading into grayish brown at the tip; beneath brownish olive.

Measurements.—Total length, 975 mm.; tail, 540; foot, 127; skull, total length, 117.3; occipito-nasal length, 97; hensel, 84.2; zygomatic width, 80.7; intertemporal width, 36.5; palatal length, 50.7; median length of nasals, 21.2; length of upper molar series 30; length of mandible 60.7; length of lower molar series 37.5.

This species is quite unlike *P. mordax* from Java, but nearer the one from Bawean Island, from which, however, it is easily distinguished by its blackish brown tail. All these Javanese macaques appear to have the forward fan-shaped radiation of the hair from the ears, a peculiarity belonging, however, to others of the genus, but usually with a more circular radiation not so much confined to a forward movement.

The skull is very different from the Bawean Island macaque, being much smaller with a narrow rostrum, decreasing in width towards incisors; the zygomatic arch has very little expansion and is parallel with the skull, being practically straight without curve; orbits much higher than wide; a low ridge is present from frontal to occiput formed of inner ridge-like edge of orbits uniting on anterior part of the frontal, dividing again at interparietal and joining the occipital ridge on either side; tooth rows straight, palate narrow; upper incisors projecting.

PITHECUS LINGÆ, new species.

Type-locality.—Linga Island, Rhio Archipelago.

Type.—Cat. No. 101603, U.S.N.M.

General characteristics.—Size medium; hands brownish; feet whitish gray; hair long, loose.

Color.—Broad black band across forehead; top of head, neck, upper parts and outer side of thighs, rusty in certain lights, less red in others, and paler on the thighs, the hairs being dark brown at base, then barred with dark ochraceous and black and tipped with black; outer side of arms and hands dark brown, washed with buff; the hairs being dark brown at base, then barred and tipped with buff; legs smoky gray with a slight yellow tinge; feet whitish gray, hairs being brown with white tips; hair scanty; under parts and inner side of limbs, whitish; tail above like back at root, then black, changing to slate gray at tip; beneath smoke-gray.

Measurements.—Total length, 782 mm.; tail, 560; skull, total length, 111.5; occipito-nasal length, 93.9; hensel, 80; intertemporal width, 40.4; zygomatic width, 76.5; palatal length, 45.7; median length of nasals, 29.3; length of upper molar series, 29.4; length of mandible, 84.9; length of lower molar series, 37.7.

This is a reddish hued macaque with a long, loose coat of hair and a long tail, not very much like any of the other species. It varies in coloration, for another male taken on the same day, July 23, has none of the reddish hue so strongly exhibited by the type, and is more of a dark-brown hue, with a yellowish tinge. The limbs and tail are also much lighter. The skull is short and broad for its length; palate broad and the tooth rows slightly curved; teeth rather large, last premolar and molars each with four cusps; teeth of lower molar series smaller than those in the upper.

PITHECUS IMPUDENS, new species.

Type-locality.—Pulo Sugi, Rhio Archipelago.

Type.—Cat. No. 115675, U.S.N.M.

General characteristics.—Size medium, tail very long. Skull with rostrum narrow anteriorly; incisors very small; posterior edge of last molar not reaching palatal arch; tooth rows curved; nasals comparatively long, broad anteriorly; tail longer than head and body.

Color.—Space above eyes bare, flesh color, face covered with short white hairs; narrow black hairs on forehead; top of head and upper parts ochraceous and black, the hairs annulated with these colors and gray at base; outer side of thighs similar to back but paler; flanks grayish; arms and hands dark brownish gray and buff; legs smoke gray; feet similar with a yellowish tinge; under parts and inner side of limbs whitish; tail above blackish on basal half, smoke gray on remainder, beneath yellowish white.

Measurements.—Total length, 962 mm.; tail, 522; skull, total length, 109.3; occipito-nasal length, 92.6; hensel, 73.4; intertemporal width, 38; zygomatic width, 72.6; palatal length, 42.7; median length of nasals, 26.7; length of upper molar series, 27.1; length of mandible, 77.9; length of lower molar series, 34.1.

PITHECUS CAPITALIS, new species.

Type-locality.—Trong, Lower Siam.

Type.—Cat. No. 83271, U.S.N.M.

Geographical distribution.—Lower Siam and Telibon Island.

General characteristics.—Nearest to *P. fascicularis* with gray hands and feet, but without the reddish hue on head and neck. Skull much larger and very different in character.

Color.—Top of head and entire upper parts yellowish brown, the hairs gray at base, then banded with dark brown and yellow; limbs, hands, and feet grayish brown; inner side of limbs yellowish; tail above dark grayish brown, beneath yellowish white.

Measurements.—Total length, 1,143 mm.; tail, 635; skull, total length, 123; occipito-nasal length, 103.7; intertemporal width, 45; hensel, 87.7; zygomatic width, 89.8; palatal length, 53.5; median

length of nasals, 31; length of upper molar series, 32; length of mandible, 97.1; length of lower molar series, 40.1.

The example described has a very worn coat and hairs thinly dispersed on limbs and under parts. While the coloring is dissimilar to *P. fascicularis*, the great difference between that species and the Trong macaque is in the size and shape of the skull and teeth. The skull of the Sumatran species, although the animal was about of the same age, is one-third smaller. The Trong skull has a low crest from the midfrontal to the occiput; the rostrum is longer and broader; zygomatic width greater; nasals wider; bony palate deeper and longer; teeth larger; incisors more than twice as large; mandible longer and heavier, the ascending ramus broader and longer with a very slight inclination backward. A single specimen, a male, from Telibon Island has a different skull, is much smaller and a somewhat different color, and may eventually prove distinct, but at present I leave it under the name of the Trong macaque.

Genus PYGATHRIX.

PYGATHRIX ULTIMA, new species.

Type-locality.—Mount Dulit, Borneo, 3,000 feet elevation.

Type.—Cat. No. 83949, U. S. N. M. Collected by E. and C. Hose.

General characteristics.—Similar in color to *P. cristatus*, but cranial characters very different. The skull compared with that of *P. cristatus*, two adult males, is generally larger; rostrum and brain case longer and narrower; septum broader, tooth row almost straight; teeth larger and tooth rows longer; pterygoidfossa longer and pterygoids not so widely flaring; bullae much less inflated; in fact compressed and reduced; palate longer and narrower; the lower edge of mandibular angle much more rounded, and the lateral pit in the ascending ramus shallower and smaller.

Color.—Like *P. cristatus*, but averaging slightly darker.

Measurements.—Total length, 1,370 mm.; tail, 820 (skin); skull, total length, 104.2; occipito-nasal length, 87; hensen, 75.3; zygomatic width, 77; intertemporal width, 42.5; palatal length, 38.9; width, 19.4; median length of nasals, 15.1; length of upper molar series, 39; length of mandible, 75.7; length of lower molar series, 36.5.

PYGATHRIX SANCTORUM, new species.

Type-locality.—St. Matthew Island, Mergui Archipelago.

Type.—Cat. No. 104446, U. S. N. M.

General characteristics.—Similar in color to *P. obscura carbo* from Terutau and Lankawi islands, Straits of Malacca, but cranial characters quite different. Teeth large; tooth rows, rostrum and palate longer; palatal arch pointed, reaching nearly to posterior edge of second molar; pterygoids much larger and widely spaced; pterygoid fossa con-

tracted, widening at posterior edge of palate; basi-occipital wider, the lateral pits much smaller; zygomatic arch longer and more curved; occipital region broader; brain case longer and wider and orbits higher than wide, not round; mandible and lower tooth row longer.

Color.—Very like *P. o. carbo*, except the nuchal crest is creamy white and the tail is pale buffy gray.

Measurements.—Total length, 703.20 mm.; tail, 508; skull, total length, 98.8; occipito-nasal length, 81.7; hensel, 70.5; zygomatic width, 73.8; intertemporal width, 40.6; palatal length, 31.2; length of upper molar series, 27.3; length of mandible, 67.1; length of lower molar series, 34.3.

The island allies of *P. obscura* are apparently characterized by having much larger teeth than are seen in typical individuals and by the many cranial distinctions mentioned above.

PYGATHERIX FLAVICAUDA, new species.

Type-locality.—Trong, Lower Siam.

Type.—Cat. No. 83259, U.S.N.M.

General characteristics.—Belonging to *P. obscura* group, but legs from hips pale smoke gray and tail cream color.

Geographical distribution.—Lower Siam and southern Tenasserim; Kisseraing and Sir William James islands, Mergui Archipelago.

Color.—Face bare, upper lip and space over eye flesh color, darker about nose and beneath eyes. Hairs on forehead long upright and extending to ears brownish black; hairs on lips and lower cheeks long and extending backward beyond ears blackish; top of head and nape yellowish white; dorsal line mummy brown, paler than back; rest of upper parts and flanks black tinged with brown; outer side of arms very dark hair brown with a reddish tinge on shoulders and grading into black on wrists and hands; throat sparsely covered with dark brown hairs; under parts grayish brown; outer side of legs smoke gray with a brownish tinge from knee to ankle; feet blackish; tail uniform cream color.

Measurements.—Total length, 1,257 mm.; tail, 724; skull, total length, 94.7; occipito-nasal length, 77; hensel, 66.5; zygomatic width, 70; intertemporal width, 40.7; palatal length, 32.7; median length of nasals, 93; length of upper molar series, 24.4; length of mandible, 68.6; length of lower molar series, 30.

This very distinct species can at once be recognized by its cream color tail and pale legs. The examples from the islands, consisting of only a male and female, differ slightly in certain particulars. The legs are even paler than those of the type, hands and feet jet black, strongly contrasted with the arms and legs, and the skulls have a flatter brain case and broader rostrum. The material is hardly sufficient to enable a definite decision to be reached, and I leave these island examples under the name of the present species.

NOTE ON THE GOLD-EYE, AMPHIODON ALOSOIDES RA-
FINESQUE, OR ELATTONISTIUS CHRYSOPSIS (RICH-
ARDSON).

By DAVID STARR JORDAN and WILLIAM FRANCIS THOMPSON,
Of Stanford University, California.

In the basin of Lake Winnipeg the fish known as the gold-eye has considerable value as an article of food. Smoked, it is fairly to be called delicious, and as a pan-fish, although beset by small bones, its flesh is excellent, scarcely inferior to that of the whitefish. It is flaky, rather firm, and of good quality. According to Richardson, the "flesh is white, resembling that of the perch in flavor, but excelling it in richness." The fish is bright silvery in life, the eyes being, as stated by Richardson, of a bright "honey yellow," suggesting the name of gold-eye, universally given to the species by the fishermen and fish dealers of Manitoba.

The species was found by the International Fisheries Commission to be abundant in Lake of the Woods, in the Red River of the North, and in Lake Winnipeg. It is also said to abound in the lower Saskatchewan and Assiniboine, as well as in Lake Manitoba and other lakes tributary to Lake Winnipeg. The moon-eye, *Hiodon tergisus*, which is nowhere valued as food, is not found in the Winnipeg basin.

Sir John Richardson gave the gold-eye the name of *Hiodon chrysopsis*,^a his specimens being from Cumberland House on the lower Saskatchewan, near Lake Winnipeg.

Besides our specimens from the Winnipeg region, we have also examples from the White River at Gosport, Indiana, and from South Loup River, Nebraska. In all these, the eye is still yellow, although the specimens have been over twenty years in spirits.

The illustration (fig. 1) representing a female specimen from Red River of the North, at Winnipeg, is drawn by William S. Atkinson.

As to the proper specific name for the gold-eye, and the genus of which it is the type, we are still somewhat in doubt.

Rafinesque describes from the Falls of the Ohio a species he calls *Amphiodon alosoides* (misprinted *alveoides*), later called, by the same writer, *Hyodon amphiodon*. This fish has much in common with the gold-eye, and may be the same fish as supposed by Jordan and Ever-

^a Fauna Bor. Amer., 1836, p. 232.

mann. The gold-eye certainly occurs in the Ohio basin. It is, however, possible that the *Amphiodon alosoides*, with other nominal species of Rafinesque, is the common moon-eye, *Hiodon tergisus*.

The original account of Rafinesque (*Journal de Physique*, vol. 88, page 421, 1819, now almost inaccessible) is as follows, as transcribed for us by Mr. Henry W. Fowler:

Ce poisson se nomme Yellow Herring (Hareng jaune) dans l'Ohio. Cette rivière a en outre plusieurs nouvelles espèces de vraies Clupéées à dents, ainsi que des *Glossodons* (ou *Hyodon* Les.) des *Thrisses sans dents*, on *Clupanodons*, etc.

15. *Amphiodon*. (Abdominal) Différent du genre *Glossodon* (*Hyodon*, Lesueur) par mâchoires dentées, ainsi que la langue. Carène ventrale obtuse, peu visible, sans plaques. Nageoires dorsales au-dessus de l'anus. Ce genre a en outre les thoraciques appendiculées comme les Clupéées et les Thrisses, mais a 7 rayons seulement au lieu de 9, comme les *Glossodons*.

A. alveoides. Corps oblong argenté, tête dorée, mâchoire inférieure plus longue, ligne latérale à peine courbée en bas, queue fourchue. D. 10, A. 34, P. 16, C. 24. Grande espèce nommée vulgairement Shad (Alose) sur l'Ohio.

In the *Ichthyologia Ohiensis*, 1820, page 42, the subgenus *Amphiodon*, based on the *Hyodon alosoides*, which he now calls *Hyodon amphiodon*, is thus characterized: "Body lanceolate, lower jaw longer, dorsal beginning opposite base of the anal fin. The name means toothed all over."

This *Hyodon amphiodon* is said to have the diameter one-fourth the total length; jaws with large conical teeth, similar to those on the tongue; eyes round and black; iris silvery gilt; dorsal rays 10; anal 34.

In the second subgenus, *Glossodon*, based on "*Hyodon vernalis*" (= *Hiodon tergisus*), the following characters are given: "Body lanceolate; jaws equal, with small teeth, dorsal fin opposite the vent, nearly medial, beginning behind the abdominal fins. The name means toothed tongue."

In this species, the dorsal rays are 13, the anal 28; the falcation of the fin indicates the male.

In the third subgenus, *Clodulus* (*Hyodon clodulus*), we have the "body oblong, irregular or somewhat rhomboidal. Jaws nearly equal, the lower one somewhat longer and with small teeth. Dorsal fin beginning before the base of the anal fin." In *H. clodulus* (= *Hiodon tergisus* LeSueur) the dorsal rays are 15, the anal 30.

In support of the theory that the *Amphiodon alosoides* was the moon-eye and not the gold-eye, we have these phrases: "Carène ventrale obtuse, peu visible." "Nageoires dorsales au-dessus de l'anus."

On the other hand, in favor of the identity of *Amphiodon alosoides* with the gold-eye, we have the backward position of the dorsal (although it is still farther back in the gold-eye), the presence of ventral carina, however little visible in comparison with the river herring, and especially the numbers of fin rays, D. 10, A. 34, indicating a very long anal and a short dorsal, both characteristics of the gold-eye. On the whole we have little doubt that Rafinesque had the

gold-eye in mind, as *Amphiodon alosoides*, and also in his *Hyodon heterurus*. If this view be not accepted, these two nominal species will be placed in the synonymy of the moon-eye, *Hiodon tergisus*. The name *chrysopsis* must then stand for the gold-eye and the species will be *Elattonistius chrysopsis*.

We regard the gold-eye as certainly generically distinct from the moon-eye, adopting for the former Rafinesque's name *Amphiodon*.^a Gill and Jordan have defined *Elattonistius* as a subgenus by the *carination* of the entire abdomen and by the shortness of the dorsal fin. Equally important is the distinction perhaps indicated by Rafinesque of the backward insertion of the dorsal, which in the gold-eye is considerably behind the front of the long anal, about over the ninth ray. In the moon-eye the anal is shorter and the dorsal is inserted in front of it, its middle directly over the vent.

Description of the gold-eye.—Two specimens from the Red River of the North at Winnipeg, Manitoba, 235 and 265 mm. in length;

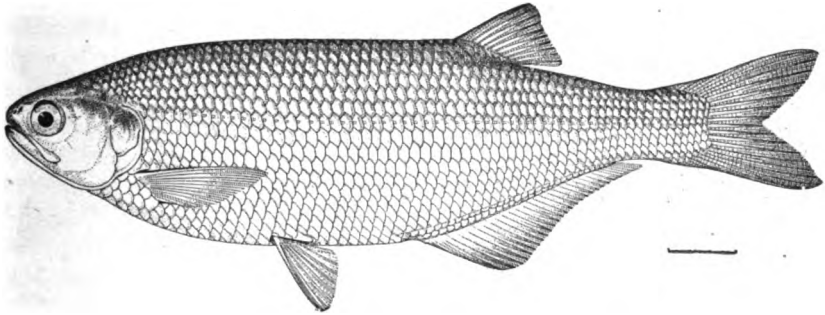


FIG. 1.—*AMPHIODON ALOSOIDES*.

one from Warroad, Lake of the Woods, 310 mm.; one from Gosport, Indiana, 172 mm., and two from South Loup River, Nebraska, 97 and 126 mm. long.

Head 4 to $3\frac{1}{2}$ in body length to base of caudal, smallest in adults; depth $3\frac{1}{4}$ to $3\frac{1}{2}$ in body length; eye $3\frac{1}{8}$ to $3\frac{1}{2}$ in head, larger in young; snout 5; interorbital space equal to eye diameter; maxillary measured from tip of snout, two in head; D. 9 or 10 (fully developed rays); A. 29 to 35; scales 6–58 to 60–12 (18 in transverse series from insertion of dorsal to insertion of anal); 8 between ventrals and lateral line; B. 9.

Body greatly compressed, its width $3\frac{1}{2}$ in depth, greatest width above lateral line, thinning to ventral outline, which is strongly carinated from isthmus to anal fin; depth intermediate between that of *Hiodon tergisus* and *H. selenops*; ventral and dorsal outlines parallel and straight in center of body for nearly half length; axis of body between snout and caudal peduncle high, leaving three-fifths of depth below; dorsal outline hence tapering less to head and tail than ven-

^a Journal de Physique, 1819, p. 421=*Elattonistius*, Gill and Jordan, Bull. 10, U. S. Nat. Mus., 1877, p. 68.

tral, especially posteriorly; caudal peduncle moderately broad, strongly compressed, and rather short, barely tapering, if at all, viewed laterally; head rather short, especially from snout to occiput, compressed, conical, varying in concavity of dorsal outline in sex, and straight from corner of mouth to below pectorals; its longitudinal axis tilted decidedly upward to about 30 degrees from body axis, owing to low position of opercular plates; snout strongly gibbous from above nostrils to tip, mouth oblique; lower jaw equal to upper, included laterally; maxillary extending to below a point midway between pupil and posterior margin of eye; eye large, very close to angle of mouth, the suborbital bones very narrow.

Dentition very complete; vomer toothless, small; parasphenoids extending far forward, with strong canines, a large series on each side, one or two smaller series between, usually two posteriorly, these strongest in the male; palatines with one large series each of canines; ecto- and entopterygoids with bands of villiform teeth;

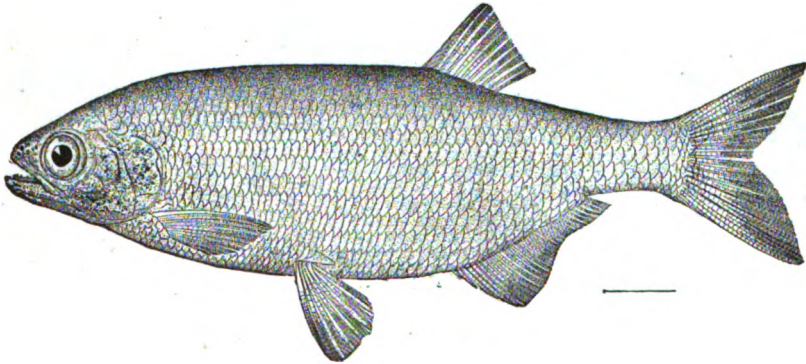


FIG. 2.—*HIODON TERGISUS*.

glossohyal toothed similarly to parasphenoid, but with a central band of villiform teeth, the area broader; premaxillaries with a single series of small teeth, set widely, visible when jaws are closed; maxillaries with a minute series larger anteriorly; dentaries with inner and outer small series, and between a band of minute teeth. Teeth of dentaries closing against those of palatines.

Lateral line straight, nearer dorsum; scales fairly large, larger than subopercle, thin, with transparent, flexible margin, two series inclosing the base of anal fin. Adipose formation over preorbitals and from dorsal edge of eye to upper attachment of opercle; ventral scale present, half of ventral length.

Dorsal fin inserted somewhat behind insertion of anal, about over the ninth ray, contrasting with that of *Hiodon tergisus* and *H. selenops*, in which the insertion is well in advance of the vent; the fin low, its height $1\frac{1}{2}$ in head, its base short, two-thirds its height, slightly concave; caudal deeply forked, its lower lobe longer; pectorals long, reaching six-sevenths of distance to ventrals; latter

small, equal to dorsal height; anal longer than in allied species, its base nearly equal to body depth; falciform, its border notched (in males) or concave, rays anteriorly greatly heightened, in males especially, to about two-thirds head; posterior rays very short in both sexes; base of anal greatly compressed and slightly concave in outline.

Color, in spirits, lustrous silvery, bluish above, colorless below, fins with dark margins, save for ventrals, which are clear.

Iris bright golden yellow; sides of head with golden luster.

The sexual differences are somewhat marked, and some differences are observable in dentition. These may be due to age. The specimens from Winnipeg, Red River of the North, are of moderate size, 235 and 265 mm. in length, to the base of the caudal, one female, the other male. The parasphenoids in both have a single median series of strong canines similar to the lateral series anteriorly, doubling posteriorly; the teeth on the palatines are large and strong; the concavity of the dorsal outline of the head is not very marked in either, and the snout is rounded. The anal fin is strongly notched in the male, but not in the female. In the specimen from Warroad, Lake of the Woods, an adult male of large size, 310 mm. in length to the base of the caudal, the space between the nostrils and occiput is strongly convex, the head appearing to be much more strongly turned upward, and the snout is almost, if not quite, truncate. The teeth on the parasphenoids are less strongly developed than in either male or female from Winnipeg, two rows of small teeth being present anteriorly between the lateral rows, and the palatine teeth are not as strong. The anal fin is strongly notched.

The remainder of the specimens from White River, Indiana, and South Loup River, Nebraska, are of smaller size and immature, but, in so far as can be seen, resemble the Winnipeg specimens. The differences of the Warroad specimen may be due to sex and age.

Measurements of Amphiodon alosoides.

Locality.	War road, Lake of Woods.	Winnipeg, Red River.	Winnipeg, Red River.	South Loup River, Nebraska.	South Loup River, Nebraska.	Gosport, Indiana.
Specimen number.....	13108	13086	13087	861	859	1238
Length without caudal (mm.)..	310	265	235	126	97	172
Head.....	.225	.21	.23	.24	.23	.215
Depth.....	.30	.30	.31	.28	.28	.30
Caudal peduncle:						
Length.....	.105	.10	.095	.10	.09	.095
Depth.....	.085	.10	.10	.10	.105	.11
Eye.....	.06	.06	.065	.075	.075	.06
Snout.....	.04	.04	.047	.05	.045	.045
Interorbital space.....	.065	.06	.065	.065	.065	.06
Maxillary, from tip of mouth..	.11	.11	.11	.125	.12	.11
Dorsal rays (fully developed) .	9	10	9	10	10	10
Anal rays.....	34	32	32	29	32	31
Scales.....	6-61-12	6-60-12	6-58-12	6-58-12	6-60-11	6-60-12
Scales, occiput to dorsal.....	42	40	39	40	40	41
Snout to anus.....	.66	.64	.64	.65	.65	.63
Pectoral length.....	.20	.20	.22	.225	.22	.20
Ventral, length longest ray.....	.13	.13	.13	.13	.12	.125
Dorsal, length longest ray.....	.11	.11	.13	.135	.12	.125
Anal, length longest ray.....	.14	.135	.14	.13	.15	.12
Sex.....	Male.	Female.	Male.	Immature.	Immature.	Immature.

STUDIES OF THE NORTH AMERICAN GEOMETRID MOTHS OF THE GENUS *PERO*.

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The genus *Pero* Herrich-Schaeffer (= *Azelina* Guenée in part) has been a perplexing one to American students, and from the beginning of my studies in the Geometridæ I have been gathering material with a view to a revision of the group in so far as it was represented on the American continent north of Mexico. At the outset three species were recognized, *honestarius* Walker (the *ancetaria* of our lists with its variety *peplaria*), *giganteus*, new species, then thought to be the *occidentalis* of Hulst, and a small western species that was generally regarded as identical with *honestarius*. *Behrensarius* Packard was not then autotopically known to me. There were besides these several puzzling specimens which could not be placed with any of these three forms, and it was only as material accumulated that they were set aside as good species in themselves.

Finally my own collection of one hundred and fifty odd examples was grouped into species to my own satisfaction; slides were made and structures examined, and in all cases these bore out the arrangement as based on superficial characters. Before finally revising the genus, however, additional material was sought from all available sources.

Except for one or two odd specimens the original arrangement remained until the advent of about three hundred specimens from Dr. William Barnes. These specimens from many points in the United States and southern Canada showed a greater distribution of certain of the species, and the farther away from its metropolis a species ranged the more unlike the typical examples it appeared. The work was gone over again with the result that two more new species were discovered; and, while the distinctness of the other species was not at all rendered questionable, it was found that there existed a greater range of variation than was at first believed.

The final result of these studies shows that there are nine species represented in the faunal region above limited, and it is probable that one or two more remain to be discovered. Indeed, among the eight hundred odd specimens examined in reaching the conclusions here set forth are several examples which are doubtfully referred to two species. While it is quite probable that they represent geographical races of the species with which they have been tentatively associated, additional material may prove them to be distinct.

Five of these nine species, though, except one, originally described as distinct, have at one time or other been regarded as mere varieties of a single species (*honestarius*), and all but a very few of the hundreds of specimens sent me for study arrived under names synonymous with this. The other four species, here described as new, were, when received, also arranged under this name.

In the preparation of this paper the writer has to thank the following gentlemen for the loan of specimens, without which the paper could not have appeared in its present more complete form: Dr. William Barnes, of Decatur, Illinois, for his entire collection in this group; Dr. Harrison G. Dyar for the material in the United States National Museum; Messrs. William Beutenmüller and Jacob Doll for the material in the American Museum of Natural History, New York, and the Brooklyn Institute of Arts and Sciences, respectively; and Messrs. George H. Field and W. S. Wright, of San Diego, California; R. F. Pearsall, of Brooklyn, New York; William H. Broadwell, of Newark, New Jersey, and Otto Buchholz, of Elizabeth, New Jersey. To all these gentlemen the writer expresses his thanks. Further acknowledgment should be made to Prof. John B. Smith for the use of the material in the Hulst collection. I am also indebted to Mr. L. B. Prout, of London, England, for helpful suggestions in regard to the older generic and specific names, and for comparison of specimens with the Walker types in the British Museum.

Genus *PERO* Herrich-Schaeffer.

- 1850-58. *Pero*, HERRICH-SCHAEFFER, Samml. Auss. Schmett., p. 28.
1857. *Azelina* (part) GUENÉE, Spec. Gén., vol. 9, p. 156.
1860. *Azelina* WALKER, Cat. Brit. Mus., vol. 20, p. 185.
1876. *Azelina* PACKARD, Monogr. Geom., p. 520, pl. 6, fig. 12.
1881. *Azelina* BUTLER, Ann. and Mag. Nat. Hist., ser. 5, vol. 8, p. 33.
1883. *Azelina* MEYRICK, Trans. and Proc. New Zeal. Inst., vol. 16, p. 106.
1896. *Marmarea* HULST, Trans. Amer. Ent. Soc., vol. 23, p. 379.
1896. *Azelina* HULST, Trans. Amer. Ent. Soc., vol. 23, p. 380.
1900. *Azelina* DRUCE, Biol. Centr.-Amer., Lep. Het., vol. 2, p. 60.
1902. *Marmarea* HULST, Bull. 52, U. S. Nat. Mus., p. 344.
1904. *Marmarea* DYAR, Proc. U. S. Nat. Mus., vol. 27, p. 913=*Azelina*.
1905. *Azelina* WARREN, Nov. Zool., vol. 12, p. 367=*Pero*.

Front square, heavily haired but smooth; palpi stout, subascending, projecting beyond front, as a whole slightly longer than the width of the space between the eyes; tongue well developed; antennæ filiform or dentate, flattened, finely ciliate below. Thorax robust, heavily haired above and below, with distinct central crest dorsally. Abdomen rather stout, smooth, in male ending in broad tuft. Tibial epiphysis of anterior legs originating at middle of tibia and extending to or just beyond apex. Posterior tibia not swollen, with two pairs of spurs, without hair pencil. Fore wings broad, falcate; costa straight or slightly produced on basal third and turning abruptly near apex; outer margin excised between the veins from apex to Cu_2 . Veins R_1 and R_2 from cell; R_3 , R_4 , and R_5 stemmed and forming with R_2 an accessory cell; M_1 from cell. Hind wings with outer margin excised between all veins, especially from M_1 to Cu_2 . Sc anastomosing with R on second sixth; M_2 absent.

Marmarea Hulst was made a distinct genus on the character of the dentate antennæ of the male of *occidentalis*. Dyar mistaking *giganteus*, a species with filiform antennæ, for *occidentalis* made the genus a synonym of *Azelina*. In truth, *occidentalis* has dentate antennæ in common with *colorado*, but this, in my opinion, can hardly be considered of generic value, especially in view of the fact that *occidentalis* in habitus and genitalic structure has strong affinities with *modestus*, a species with filiform antennæ, while *colorado* has affinities in these same peculiarities with *morrisonatus*, also a form with filiform antennæ. In other words, aside from antennal structure they differ more from each other than they do from species with simple antennæ. For these reasons I have here regarded the genus as identical with *Pero*.

The genus *Pero* comprises a well-defined and distinctive group of insects, and has for its ally the genus *Azelina* Guenée (= *Stenaspilates* Packard), as it is now limited by Warren, from which it is distinguished chiefly by the simple or dentate antennæ in the male. The coloring in the genus varies from light gray and light ochereous, through all shades of these to dark umber brown. The primaries are typically divided into three transverse regions, though the partial obsolescence of the inner line frequently gives the appearance of but a single division; or this line may be obscured by shadings of a similar color producing the same effect. The inner or intradiscal line originates on the costa about one-third out from the base, extends obliquely outward to the center of the cell, turns inward to the cubital vein, and is thence twice outwardly scalloped to inner margin, the last sweep usually extending considerably inward to the base of the wing. The anterior portion of this line is heaviest and is always visible to at least the center of the cell; usually it is very conspicuous.

The outer or extradiscal line begins about one-fourth in from the apex, follows in general the course of the outer margin of the wing and may be either gently waved or strongly undulated, one outward wave being between R_5 and Cu_1 and another between Cu_2 and the anal vein; the inward wave produced by the union of these two is larger and deeper than either of the outward ones. The secondaries are divided into two regions by a straight, slightly curved, undulate or denticulate line which crosses the wing outward of the middle and terminates at the inner margin at a variable distance from the anal angle.

The genitalia when mounted on slides are more or less triangular or pentagonal in form and display excellent characters for the separation of the species. The apical-inner margin of the harpes, bearing what by analogy should be the clasper, is very characteristically shaped and affords the best means of distinguishing between the various species. The spreading out and mounting of the genitalia apparently does not in the least interfere with the shape of the structure, and in a series of ten mounts of one species all were practically alike. This was true of the other species, and constancy of form is the rule with all the parts of this structure. The uncus may be straight or slightly bent according to the species. The scaphium usually offers something that is distinctive. The penis may or may not have an apical process which is much alike in related species.

TABLE OF SPECIES.

1. Species variegated with brown, yellow, and olivaceous.....	2
Species not variegated or, if so, entirely lacking the olivaceous tint.....	3
2. Ground color of primaries bright yellowish or faintly yellowish-olivaceous, the inner cross line relieved; shadings burnt brown.....	<i>morrissonatus</i> .
Ground color of primaries whitish and decidedly olivaceous, the inner cross line almost lost in the shading below cell; shadings chocolate-brown with purplish cast.....	<i>marmoratus</i> .
3. Species large, 45 mm. or over in expanse.....	<i>giganteus</i> .
Species smaller, 40 mm. or less in expanse.....	4
4. Outer line of primaries very strongly sinuous.....	<i>modestus</i> .
Outer line of primaries gently and smoothly waved.....	5
5. Ground color of wings granite-gray; median band of primaries deep fawn-brown.....	<i>behrensarius</i> .
Species not so colored.....	6
6. Primaries scattered over with cinereous scales, outer line externally and inner line internally bordered by a narrow cinereous line.....	<i>occidentalis</i> .
Primaries without cinereous scales.....	7
7. Ground color of wings creamy or whitish-gray; shadings yellowish-brown. <i>colorado</i> .	
Ground color of wings stone or bluish gray or reddish-brown.....	8
8. Male with grayish shadings and a yellowish patch opposite discal spot; female with bright reddish-brown shadings.....	<i>peplarioides</i> .
Male with black shadings; female with reddish-brown shadings with an umber hue.....	<i>honestarius</i> .

PERO HONESTARIUS Walker.

Plate 13, figs. 1, 2; Plate 14, figs. 1, 2, 4-8; Plate 15, fig. 1.

1860. *Azelina hubneraria* † WALKER, Cat. Brit. Mus., vol. 20, p. 186.
 1860. *Azelina honestaria* WALKER, Cat. Brit. Mus., vol. 20, p. 258.
 1866. *Azelina stygiaria* WALKER, Cat. Brit. Mus., Suppl. 5, p. 1548.
 1868. *Azelina honestaria* GROTE and ROBINSON, Trans. Amer. Ent. Soc., vol. 2, p. 81=*hubneraria*.
 1876. *Azelina hubnerata* † PACKARD, Monogr. Geom., p. 520, pl. 11, figs. 58, 59.
 1876. *Azelina stygiaria* PACKARD, Monogr. Geom., p. 523.
 1881. *Azelina hubneraria* BUTLER, Ann. and Mag. Nat. Hist., ser. 5, vol. 8, p. 33.
 1881. *Azelina honestaria* BUTLER, Ann. and Mag. Nat. Hist., ser. 5, vol. 8, p. 33.
 1881. *Azelina stygiaria* BUTLER, Ann. and Mag. Nat. Hist., ser. 5, vol. 8, p. 33.
 1886. *Azelina hubnerata* HULST, Ent. Amer., vol. 2, p. 49.
 1886. *Azelina stygiaria* HULST, Ent. Amer., vol. 2, p. 49=*hubnerata*.
 1886. *Azelina honestaria* HULST, Ent. Amer., vol. 2, p. 49=*hubnerata*.
 1890. *Azelina hubneraria* † PACKARD, Fifth Rept. U. S. Ent. Comm., p. 526.
 1895. *Azelina peplaria* HULST, Ent. News, vol. 6, p. 14.
 1895. *Azelina stygiaria* HULST, Ent. News, vol. 6, p. 14=*peplaria*.
 1895. *Azelina hubnerata* HULST, Ent. News, vol. 6, p. 14, var. of *peplaria*.
 1895. *Azelina honestaria* HULST, Ent. News, vol. 6, p. 14=var. *hubnerata*.
 1900. †*Azelina hubneraria* † DRUCE, Biol. Centr.-Amer., Lep. Het., vol. 2, p. 61.
 1900. *Azelina honestaria* DRUCE, Biol. Centr.-Amer., Lep. Het., vol. 2, p. 61.
 1900. *Azelina peplaria* † CAUDELL, Ent. News, vol. 11, p. 583, larva.
 1902. *Azelina ancetaria* † HULST, Bull. 52, U. S. Nat. Mus., p. 344.
 1902. *Azelina honestaria*, HULST, Bull. 52, U. S. Nat. Mus., p. 344=*ancetaria*.
 1902. *Azelina peplaria* HULST, Bull. 52, U. S. Nat. Mus., p. 344, var. of *ancetaria*.
 1902. *Azelina stygiaria* HULST, Bull. 52, U. S. Nat. Mus., p. 344=var. *peplaria*.
 1903. *Azelina ancetaria* † HOLLAND, Moth Book, p. 352, pl. 45, fig. 23.

Male.—Expanse, 36 to 40 mm. Head and thorax umber brown scattered over with fine gray scales; antennæ yellowish with a white spot at the base of each; front with a white V or U shaped mark across the superior portion which connects the spots on the antennæ; palpi concolorous with tint of head. Abdomen gray or brownish; when the latter, the segments are narrowly darkened posteriorly. Ground color of wings soft gray and usually finely strigate, especially outwardly and along costa, though the strigations are often reduced to shapeless atoms. Inner line of primaries blackish, the scallops not strongly pronounced; outer line rather smoothly undulate. Inner area heavily shaded or mottled with umber brown, the ground color showing through, especially just internally of the limiting cross line. Median area similarly shaded and assuming an intense blackish-brown along outer line. Outer area shaded with olive gray. Discal spot white, angular, linear. Fringe brown. Transverse line of secondaries curved, more or less denticulate though sometimes quite straight and even. Inner area smoky, densest at cross line. Outer area smoky, sometimes strigate with gray or brown. Three black intervenular spots on outer margin near the anal angle are always present, and frequently two or three other smaller ones nearer the

outer angle. Discal spot absent or barely visible. Fringe as in primaries. Beneath, smoky with the ground color showing through outwardly, the costal and central portions and the veins washed with reddish-brown. Lines of primaries absent; that of the secondaries faintly showing. Discal spot of fore wings white, conspicuous; of hind wings white, sometimes partly margined with black scales which occasionally cover the spot and give a decidedly dusky or even black appearance.

Female.—Differs from the typical male in that the ground color and darker shadings are of a reddish-brown cast, in that the shadings are not so dense and thus the inner cross line shows up more distinctly and in the outer cross line being, on the whole, considerably more sinuate.

Habitat.—Maine to Florida and westward to Alberta, Colorado, and Texas. According to the specimens before me the species flies in the Atlantic States from March 14 continuously to September 16; in the Northwest in June and July, in Colorado in August, and in Texas in June.

This is the only species in the East that is not decidedly variegated in color, and may be distinguished by that fact alone. The genitalia belong in the same series with *giganteus*, *peplarioides*, and *behnstarius*, but differs from all in some marked respects. The lower projection of the clasper is considerably longer than in any, the scaphium is relatively larger and stouter, and the form of the apical process of the penis is peculiar to itself alone.

Evidently the metropolis of the species is in the North Atlantic States, where the typical form of both sexes is common. At the extreme points, especially in the Northwest, the colors are not so bright, and the contrast between the ground color and the ornamentation is less striking.

The male is the dark form that has hitherto been called *peplaria*. That it is simply the male of *honestarius* is shown by the fact that of the 132 specimens under observation 68 of the 80 males were the black form, while 12, though dark, had the reddish-brown cast of the female. In no case did the female resemble the male in general color, all of them having the reddish-brown cast.

There are few American species of Geometridæ that have fallen into greater confusion than has *honestarius* with its sexual color variation and supposed varieties.

The name *ancetaria*, under which it has gone for a number of years, must disappear from our lists. It was first used in 1806 by Hübner in his *Sammlung Exotischer Schmetterlinge*, volume 2, and was merely an erroneous application on his part of *anceta* Cramer, a species different from the one he figures and which Mr. L. B. Prout tells me

is well known from South America. His figures, moreover, though apparently illustrating a typical *Pero*, do not represent any form known to me from North America. In build, shape, and markings it resembles most nearly our *marmoratus*, but does not have the blotch just outside the outer line on the primaries so characteristic in that species, and is suffused with a crimson tint—a character possessed by none of our species in the slightest degree.

Peplaria, which, according to our catalogue, is the next oldest name for the species, was also used by Hübner in his *Zuträge*. His figures (709, 710) represent both upper and under surfaces, and though we have his statement that the species comes from North America, I know of nothing in our fauna that approaches it. Certainly it is not the form to which Hulst applied the name. It probably is congeneric with the species listed in our fauna under *Stenaspilates*, though from the female (which sex alone is depicted) this can not be said with absolute certainty. The course of the extradiscal line of both wings is peculiar, the sharp angle in that of the secondaries being especially characteristic, while the yellowish color of the under side of the wings is unique, reminding one of certain of our *Gonodontis* species.

Hubneraria Guenée^a is another name for Hübner's *ancetaria*, the author discovering the distinctness of the latter species from *anceta* Cramer and rightly renaming it.

Honestaria Walker is the first valid name for our North American species. The measurement he gives seems small, but Mr. Prout assures me that it is identical with American specimens sent him for comparison.

Stygiaria Walker is apparently a typical male of *honestarius*.

Packard, in his monograph, mixes specimens of what is undoubtedly *peplarioides* with *honestarius*, but refers to them in the remarks following his description as being larger in expanse of wings.

Druce says that Central American specimens of *hubneraria* (= *honestarius*) are usually darker than those from the United States. It is probable that Mr. Druce did not have the true *honestarius* before him, as on the same page he lists *honestarius* as a separate species, remarking that the specimens of this latter species are almost identical with Walker's type.

Lastly, I have excluded *atrocolorata* Hulst from the synonymy. This was described^b as a variety of *Azelina hubnerata* from seven examples. Of these types I have located only four, two in the Brooklyn Institute Museum and two in his own collection at New Brunswick. Three are typical *honestarius*, but the fourth, a female from Florida, is a totally different species with the general aspect of a

^a Spec. Gén., vol. 9, p. 159.

^b Ent. Amer., vol. 1, p. 205.

Stenaspilates. I am, therefore, holding Hulst's name on this specimen, representing a species which apparently has as yet received no other appellation.

The complete life history of *honestarius* has not yet been worked out; nor indeed has it been worked out in any of our species.

The larva is described by Mr. A. N. Caudell as follows:

Length, 35 mm. Head 2.5 mm. wide, strongly bilobed, the lobes light ash-colored above and obtusely angled. Inner anterior borders of the lobes darker, almost fuscous. Face lighter, especially the lower half of the triangular clypeus. General color of the body brownish, mottled with longitudinal splashes of a lighter shade. Tubercles black, minute. Hairs microscopic, black. Thoracic legs on outer side concolorous with the body; on the inner surface, lighter. Abdominal legs colored same as the body on the outer surface, but black on the inner sides, and the venter between the anal pair is also black, bordered posteriorly with white. There is an irregular, not prominent, transverse ridge on the twelfth segment.

The larva fed on wild cherry, and entered the ground on July 10, the imago emerging in the following August.

Professor Packard states in his *Forest Insects* that Miss Emily L. Morton raised it commonly on wild cherry, and that those fed on maple, "the usual food plant," died.

PERO GIGANTEUS, new species.

Plate 13, fig. 3; Plate 15, fig. 3.

1904. *Azelina occidentalis*† DYAR, Proc. U. S. Nat. Mus., vol. 27, p. 913, var. of *ancetaria*; larva.

1906. *Azelina occidentalis*† TAYLOR, Check List Brit. Col. Lep., p. 37.

Expanse, 45 to 51 mm. Head and body pale purplish-gray to reddish-brown, the latter color usually predominant in the female, though not entirely confined to that sex. Antennæ yellowish with a white spot at the base of each which are frequently connected by a concolorous line that extends across the superior part of the front. Ground color of wings whitish-gray with more or less of a yellowish, brownish, or faint purplish cast. Inner line of primaries broad and conspicuous from costa to center of discal cell, thence obsolete to cubitus, but reappearing less strongly below this vein and continuing with the usual scallops to inner margin. Outer line brown, sharply defined externally but blending with the median shade internally, usually quite strongly sinuous and sometimes forming angles on the veins in the lower part of the wing. Inner area speckled, often profusely, with gray. Median area with or without speckles and usually filled in with umber-brown (male) or reddish-brown (female) which becomes intense at the outer line. Outer area with the speckles finer, and forming transverse strigations which, between veins M_3 and Cu_2 , near outer line and on inner margin near anal angle, are clustered together in more or less dense clouds.

Small, pure white dots usually surrounded by a brown border are between veins R_5 to Cu_1 near the outer margin, though frequently two or more of these are absent. In the cell between the branches of cubitus a black dot is situated. Discal spot white, conspicuous, linear. Fringe brown. Secondaries with irregular transverse line brownish followed by a whitish line which is the more prominent of the two. Inner area slightly darker outwardly, the color increasing in height in the outer area. Sometimes a still darker shade, becoming intense at the anal angle, is present in the outer area extending parallel and close to the cross line. On the margin near the anal angle are from one to four jet black spots. Discal spot absent or reflected from beneath as a very faint dusky spot. Fringe as in primaries. Beneath paler than above and dusted over more or less profusely with grayish or blackish atoms. Outer line of primaries well marked, denticulate; discal spot white, linear, sometimes marked inwardly with black. Transverse line of secondaries very sharply denticulate; discal spot large, black, oval.

Habitat.—From British Columbia southward to California and eastward to Colorado. Specific localities are: British Columbia: Arrowhead Lake, July 1 to August 7; Kaslo, July 15 to August 21; Wellington, April 15. Vancouver: July 16 to 23. Washington: Tacoma. Oregon: Dally. California: Cazadero, Sonoma County, August 18. Utah: Stockton, July 24 to August 1; Provo, July 29 to August 12. Colorado: Glenwood Springs, June 8 to September 15; Chimney Gulch, Golden, June 30.

This is the largest species of the genus and may be known by its large size alone. It is a close ally to *peplarioides* which species also approaches it most nearly in size. In *giganteus* the outer line of the primaries is usually considerably more angulate at the veins, and the male lacks the faint olivaceous tint of *peplarioides*. Perhaps the best distinguishing feature will be found in the habitat of the two species; *giganteus* is apparently common in British Columbia and Vancouver Island, becoming more rare as the southern and eastern limits of its range are approached, and may not extend south of the northern third of California; *peplarioides* extends through New Mexico and Arizona, and is common in the southern third of California. The two forms may fly together in middle California. The genitalia of *giganteus* are much like those of *peplarioides*; the clasper is narrower than in that species and the scaphium and uncus are somewhat broader.

This species has been generally regarded as the *occidentalis* of Hulst and indeed not without some justification, as Hulst himself has a female specimen in his collection labeled as a type. This, however, is from Colorado, and in his diagnosis of *occidentalis* he specifically gives California as the locality from whence the species is described.

Type.—Cat. No. 13124, U.S.N.M.

Doctor Dyar has described the egg and first two stages of the larva as follows:

Egg: Elliptical, smoothly and evenly rounded, no perceptible flattening nor truncation; surface smooth, shagreened. Shining sordid olivaceous, under a lens minutely black speckled; size, 0.9 by 0.7 by 0.65 mm.

Stage I: Head rounded, bilobed, pale brown, erect, sutures depressed. Body moderately elongate, normal, whitish, marked with irregular green rings from the alimentary canal before eating; a very faint, narrow, brown subdorsal line. Segments annulate; cervical shield small, black; tubercles black, a slight blackening around the hair dots only; setæ stiff, minutely flared at tip.

Stage II: Face below and epistoma broadly bluish white, edged above with a straight black shade; vertex yellowish, with brown black spots in alternating oblique rows; width, 0.75 mm. Body moderately slender, normal, dark gray, many fine irregular brown lines on a greenish-gray ground; venter darker than dorsum, which is irregularly diluted greenish. Feet concolorous; tubercles round, black; setæ pointed, dark.

In the second stage the larvæ began to hibernate and finally died off so that the complete life history was not obtained.

PERO PEPLARIOIDES Hulst.

Plate 13, figs. 4 and 5; Plate 15, fig. 2.

1871. ?*Azelina hubneraria* † PACKARD, Proc. Bost. Soc. Nat. Hist., vol. 13, p. 386.

1881. ?*Azelina hubneraria* † BUTLER, Papilio, vol. 1, p. 221.

1898. *Marmarea peplarioides*, HULST, Can. Ent., vol. 30, p. 218.

1902. *Marmarea occidentalis*, var. *peplarioides*, HULST, Bull. 52, U. S. Nat. Mus., p. 343.

Male.—Expanse, 35 to 38 mm. Head and thorax soft gray with a delicate tinge of purplish. Abdomen gray with a light reddish-brown cast. Antennæ pale yellowish with a white mark at the base of each which frequently are connected by a faint whitish line across the superior part of the front. Ground color of wings whitish-gray with or without a faint washing over of yellowish or olivaceous, and more or less sparsely irrorate with blackish. Occasionally the surface of the fore wings is slightly washed over with a warm brown tint, but this, a constant character of the female, is of the rarest occurrence in the male, and is never so marked as in the opposite sex. Inner line of primaries conspicuous from costa to middle of cell as a rather broad brown dash directed outwardly; below this point the line is absent or only vaguely indicated. Outer line brown, not separated from the median shade, variably sinuous, but usually not very strongly so. Inner area becoming slightly darker outwardly, continuing darker into median space and becoming very dark umber brown in the outer portion of this area. In the costal portion of the discal cell, between the inner line and discal spot, is a yellowish patch usually very conspicuous and never altogether absent. Outer area composed of the unmodified ground color, or with diverse clouds, more or less intense, but when present always arranged as to leave an irregular whitish line extending through the center of the field. Near the outer margin

a small white dot is present between veins R_2 and M_1 and another still smaller one is between veins M_2 and Cu_1 . Very rarely this second dot is absent. Also a black dot of similar proportions is between the two branches of cubitus. Discal spot, white, linear. Fringe concolorous with ground color or distinctly brownish. Transverse line of secondaries irregular, faintly brownish, and bordered outwardly with white—the really conspicuous part of the line. Outer area darkly shaded at anal angle. A black spot between veins Cu_1 and Cu_2 and sometimes two or three other smaller ones between adjacent veins. Discal spot absent or showing as a faint dusky patch. Fringe as in primaries. Beneath, paler than above, sometimes almost whitish, and more or less dusted with blackish atoms, especially on secondaries; both wings shaded costally and outwardly with faint purplish or brownish. Outer line of primaries showing on anterior portion of wings. Discal spot as above. Transverse line of secondaries present across wing; dark shading in anal angle as on upper side; discal spot large, black oval.

Female.—Expanse, 39 to 42 mm. The ground color of the wings is approximately the same as in the male, but entirely lacks the olivaceous tints of that sex and is so heavily shaded with browns of various shades that a different insect is suggested. The head, thorax, and abdomen may vary from lilacinous, through pale yellowish-brown to dark purplish brown, the head and thorax always being the most heavily shaded. Primaries and secondaries with the ornamentation as in the male, but instead of the umber brown shadings is suffused with warm browns, pale yellowish to dark purplish-brown with a reddish admixture. Beneath the sexes are much alike, the female, on the whole, a little darker.

Habitat.—Southern half of California, New Mexico, and Arizona. Specific localities: California: San Diego, March 14 to July 1; Palo Alto, March; Havilah; Claremont; Alameda County, May; Los Angeles; Pasadena, May 1; Alta Vista, March 31. New Mexico: Beulah, 8,000 feet, July 28 to 31. Arizona: San Francisco Mountains, 8,000 to 10,000 feet, July 23; Yuma County, March.

This species is allied to the preceding, and for distinguishing characters see remarks under that form.

PERO BEHRENSARIUS Packard.

Plate 13, fig. 7; Plate 16, fig. 4.

1871. *Azelina behrensaria* PACKARD, Proc. Bost. Soc. Nat. Hist., vol. 13, p. 386.

1876. *Azelina behrensata* PACKARD, Monogr. Geom., p. 521, pl. 11, fig. 60.

1881. *Azelina behrensaria* BUTLER, Ann. and Mag. Nat. Hist., ser. 5, p. 33=
honestaria?

1886. *Azelina behrensata* HULST, Ent. Amer., vol. 2, p. 49=*hubnerata*.

1896. *Azelina behrensata* HULST, Trans. Amer. Ent. Soc., vol. 23, p. 380.

Expanse, 35 to 39 mm. Head and body granite-gray to grayish-brown, the segments of the abdomen usually dark brown posteriorly;

palpi and inferior portion of front often light brown; antennæ yellowish or light brown with a white spot at the base of each, which are rarely connected by a faint, broken line across the front. Ground color of wings soft granite-gray, more or less speckled over with dark-brown atoms which occasionally form short strigations on the costa and in the outer area of primaries. Inner line of primaries conspicuous, sometimes broad and diffuse, scalloped, the first sweep from costa less oblique on the whole than in the other species. Outer line distinct, rather evenly sinuous, usually not producing angles at the veins. Median area fawn-brown, rarely deep brown, contrasting strongly with the granite-gray inner and outer area. Discal spot white, angular, linear, quite large, and conspicuous. Secondaries divided subcentrally by a denticulate or wavy line, the greatest angle or wave on the first anal vein. A small brownish discal spot sometimes showing. Three or four black lunules are on the outer margin near the anal angle. Beneath, smoky-gray, washed over with pale brownish on costal and outer areas, and with a patch of dark brown strigations on inner area of secondaries. Cross lines occasionally visible. Discal spot of fore wings as above, but smaller and margined on one side with black; of secondaries quite large, conspicuous, and composed of closely set atoms which rarely disperse, leaving a dusky spot.

Habitat.—"California" (Packard); Sierra Nevada, California, Oregon (Am. Mus. Nat. Hist.); Oregon (W. S. Wright); Portland, Oregon, June (J. A. G.); Rossland, British Columbia, June 3 (U.S.N.M.).

A very distinct and easily recognized species, separable from all others by the granite-gray ground and the sharply defined brown median area. The male genitalia are nearest to *honestarius* but are more triangular in form.

Judging from the specimens in hand Oregon is the true home of the species, since seven of the nine examples come from that State through three different sources. The other two localities, however, bespeak a range extending from lower British Columbia to central California. It is probable that the species is alpine, occurring on the Cascade and Sierra Nevada mountains.

PERO OCCIDENTALIS Hulst.

Plate 13, fig. 12; Plate 16, fig. 5.

1896. *Marmarea occidentalis* HULST, Trans. Amer. Ent. Soc., vol. 23, p. 380.

Expanse, 38 to 40 mm. Head and thorax light to dark brown, the latter occasionally sprinkled with cinereous scales, especially on the collar; abdomen paler, more or less finely mottled. Antennæ yellowish, with a white spot at the base of each, and usually a whitish line extends across the front connecting these spots. Ground color of wings dark yellowish, rarely granite gray, and sparsely sprinkled

over with cinereous and some black scales. Inner line of primaries dark brown or black, well defined, usually complete and with the scallops strongly marked. A faint cinereous line, often mixing with the ground color, just precedes it. Outer line black, rather evenly but strongly sinuous and succeeded by a fine cinereous line. Inner area slightly shaded with brown, and with a cinereous cast on costal and inner margins. Median area shaded heavily with brown, usually from the center of the field to the outer line, where it frequently assumes an intense brown. Outer area only very slightly shaded and more or less strigate. There are two to four white submarginal spots between veins R_2 and Cu_1 and a black spot between Cu_1 and Cu_2 . Discal spot white, angular, linear, though sometimes reduced to a small even spot. Fringe brown or yellowish. Secondaries smoky with a tinge of ochreous. The transverse line brown, irregular, and bordered externally by a conspicuous white line which occasionally becomes quite broad toward inner margin. Three black triangular marks are on the outer margin between Cu_1 and the inner margin, and sometimes the marginal line, usually brown, is of this same color. Discal spot absent or only vaguely indicated. Fringe as in primaries. Beneath light brown to smoky, whitish toward inner margin of both wings and more or less scattered over with dark-brown scales or strigations. Outer line of primaries in part and transverse line of secondaries repeated, the latter more sharply denticulate than above and conspicuously marked externally with white. Discal spot of fore wings as above, but marked to some extent on one side with black; of hind wings large, oval and black or dark brown. Fringe as above.

Habitat.—Rossland, British Columbia, June 8; Pullman, Washington, May 15 (Dyar); Oregon (Wright); Sierra Nevada, California (Beutenmüller); California (Hulst); Nevada (Doll).

A species resembling *modestus* in ornamentation, but on the whole larger. The scattering of cinereous scales over the primaries and the similarly colored narrow borders to the cross lines are peculiar.

The species has not been recognized since it was first described, and indeed it is doubtful whether Hulst himself knew the limits of his species, as no *occidentalis* probably ever reached an expanse of wings of 50 mm., the greatest measurement given by him in his diagnosis of the species. The species from which this measurement was made undoubtedly refers to *giganteus*, a Coloradan specimen of which is in his collection labeled as a type of *occidentalis*.

The dentate antennæ of the male, on which character the genus *Marmarea* was based and of which *occidentalis* is the type, determines to which of the two species the name should apply.

The genitalia are stout and robust and the basal projection of the clasper short and broad. The scaphium hook is provided with a shoulder, as in *behrensarius*.

PERO MODESTUS, new species.

Plate 13, fig. 13; Plate 16, fig. 6.

Expanse, 30 to 38 mm.; average expanse, about 34 mm. Head and body light to dark gray with a yellowish tint, and sometimes more or less heavily shaded with umber brown. The brown, where it occurs on the thorax, is usually smoothly applied, but on the abdomen it is distributed in minute speckles. Antennæ light grayish-yellow, usually with a white spot at the base of each, which rarely are connected by a concolorous line across the front. Ground color of wings light gray with decidedly yellow or very pale brownish cast. Usually, though not always, there is a sparse scattering of brown atoms over the surface; rarely these are profuse and then cluster together in transverse shapes and give to the wings a markedly strigate appearance. Inner line of primaries dark brown or blackish, always conspicuous, narrow, and never diffuse; the scallops are usually pronounced, particularly the one between veins radius and cubitus, which extends far into the cell. Outer line concolorous with inner line, strongly sinuate, sharply defined throughout, and shaded internally with lighter brown. Inner area composed of the ground color without modification except for the atoms occasionally clustering and assuming transverse positions. Median area usually composed of the ground color, though rarely the entire field is decidedly reddish-ocherous, contrasting strongly with the remainder of the wing. There is no shading along the inner line, and that along the costa and outer line rarely reaches to the center of the field and nearly always not more than half so far. Outer area frequently with a faint diffuse cloud of light brown following the outer line but separated from it by a narrow band of ground color. Other diffuse clouds are sometimes present at the outer margin between R_5 and M_3 or near the anal angle. A narrow terminal line is present in all well preserved specimens and one to six small white intervenular dots are between veins R_4 to Cu_2 . Discal spot small, white, rounded to linear angular, and sometimes bordered with a narrow brown ring; rarely it is absent. Fringe slightly darker than ground color. Transverse line of secondaries brown, bordered externally with whitish and irregularly dentate in its course, or simply waved; it terminates on the inner margin within a rather short distance from the anal angle. Terminal line and fringe as in primaries, the former broadened and heightened in color near the anal angle and sending three or four triangular-shaped marks into the wing between M_1 to the anal vein. The outer area, especially toward and at the anal angle, is sometimes darker than the rest of the wing. Discal spot absent or indistinctly showing as a dusky spot. Beneath, paler than above and sparsely dusted with brown atoms. The extradiscal lines are usually very conspicuous, on the secondaries

more denticulate than above and frequently bordered externally with pure white. The discal spot on the fore wings is whitish and linear, but on the hind wings is large, oval, and dark brown.

Habitat.—Arizona, New Mexico, Colorado, Utah, and southeastern California. Specific localities: Arizona: Huachuca Mountains; Santa Catalina Mountains; Palmerlee, Cochise County; Redington; Prescott, Yavapai County; Baboquivaria Mountains, Pima County. New Mexico: Fort Wingate; Las Vegas; Hot Springs, 7,000 feet. Colorado: Durango; Golden; Glenwood Springs. Utah: Stockton; Beaver Valley. California: Argus Mountains. Flies from May 24, through June, July, and August, to September 21.

A rather small variable species common in the Southwest. In the course of the transverse lines it is much like *occidentalis*, but the outer line is more strongly sinuate. The ground color varies from white to yellowish or yellowish-brown and the cross lines are pronounced.

The genitalia are comparatively short and broad, as is also the clasper.

Type.—Cat. No. 13125, U.S.N.M.

PERO MORRISONATUS Hy. Edwards.

Plate 13, fig. 6; Plate 16, fig. 7.

1881. *Azelina morrisonata* HY. EDWARDS, Papilio, vol. 1, p. 121.

1886. *Azelina morrisonata* HULST, Ent. Amer., vol. 2, p. 49=*hubnerata*.

1902. *Azelina ancetaria*, var. *morrisonata* HULST, Bull. 52, U. S. Nat. Mus., p. 344.

Expanse, 35 to 37 mm. Head and thorax pale brown or yellowish, the thoracic crest paler, and the whole with scattered whitish scales. Abdomen concolorous with thorax or yet paler and usually profusely mottled with dark brown scales which sometimes congregate and form continuous bands on the posterior part of the segments. Antennæ yellowish, rarely whitish at the base. Front sometimes darker brown than vertex, the superior edge rarely with an indication of a white line connecting the whitish spots at base of antennæ. Ground color of wings variegated pale yellowish with a faint olivaceous cast to bright yellow. Inner line of primaries dark brown or blackish, well scalloped and usually well defined across the wing. Outer line moderately or rather strongly sinuate, concolorous with inner line, defined externally, shaded internally one-fourth across the median space. Inner and median areas mottled, often profusely, with dark brown, the mottlings assuming, on the whole, a transverse position. Outer area finely and rather sparsely strigate, with two oblique wavy bands, more or less pronounced, between which is a paler brown cloud. A rounded darker brown cloud is usually present between veins M_1 and Cu_2 , close to the outer line. One to three intervenular white dots near the outer margin, the subapical one largest, and a black spot between the branches of cubitus. Discal spot white,

linear, angular, often partially bordered with black. Fringe yellow or brown. Secondaries more or less suffused with smoky, rather heavily strigate, especially at inner margin and in outer area. Transverse line irregular, brown, bordered outwardly with a narrow band of ground color. A row of intervenular black spots on outer margin near anal angle. Discal spot absent. Fringe as in primaries. Beneath paler than above, finely strigate with brown, especially heavy on secondaries. Outer line of primaries evident near costa; on secondaries strongly marked and sharply denticulate. Discal spot of fore wings white; of hind wings large, brown and conspicuous.

Habitat.—Canadian region of the Boreal life zone extending southward along the mountain chains in both the east and the west. Specific localities: Arizona; Durango, Colorado; Washington; Victoria, British Columbia, June 13, 20; Wellington, British Columbia, June 15; Arrowhead Lake, British Columbia, June 1 to 15; Miniota, Manitoba, July 21; Winnipeg, Manitoba, June 8 to 15; Indian Valley, Catskill Mountains, New York, June 7, 16, July 5, 28, 30; Cohasset, Massachusetts, June 8, 30.

This peculiarly mottled form is distinguished from *marmoratus*, which it most resembles superficially, by the bright yellow or yellowish ground color which has sometimes a trace of olivaceous in it. The basal and median areas are not completely suffused with brown as in *marmoratus* and in consequence the inner line shows up more prominently. In genitalic characteristics this species is allied to *colorado* and in this structure both species depart widely from the others of the genus. The clasper is long and narrow with the basal projection also long and thumb-like in shape. The uncus as differentiated from the next species is straight, and the scaphium hook is more slender and less curved.

PERO COLORADO, new species.

Plate 13, figs. 8 and 9; Plate 16, fig. 8.

Expanse, 36 to 38 mm. Head and thorax light yellowish-brown to grayish-brown, the latter sometimes with scattered whitish scales; abdomen creamy yellow to yellow with occasionally a grayish cast. Antennæ light yellow; a white spot at base of each and the white line crossing the superior part of the front usually diffuse. Ground color grayish-white, with or without a rusty-yellow cast, and more or less besprinkled with brown scales, those of the female usually profuse and forming short strigations. Inner line of primaries yellowish-brown to darker brown, rather narrow and nearly always complete. The scallops are defined but not particularly bold. Outer line concolorous with inner, variably sinuous, though usually not very strongly so. Inner area composed of the unmodified ground

color. Median area decided yellow to brown, intensified from center to outer line, at which it becomes very dark. Outer area variously shaded and mottled with dark brown, rust color and a tinge of olivaceous, though sometimes evenly composed of the ground color. One or two usually minute submarginal white spots are between veins R_5 to Cu_1 and a black spot also is occasionally present between the two branches of cubitus. Discal spot conspicuous, white, angular, linear. Fringe testaceous to brown. Ground color of secondaries whitish, rarely with a yellowish or testaceous cast and overlaid with fuscous scales, especially along the transverse line and, to a less extent, the inner margin. Transverse line brown, variously waved and denticulated and followed by a conspicuous line of ground color. Three or four intervenular black triangles are on the outer margin near the anal angle and occasionally there are other smaller ones along the remainder of the outer margin. Discal spot absent or showing as a white, linear mark. Fringe as in primaries. Beneath whitish or very pale smoky with or without a yellowish or testaceous cast. Lines of above except the inner of primaries repeated, that of secondaries strongly denticulate. Discal spot of fore wings white, often edged on one side with black; of hind wings large, black, oval.

Type.—In collection of Dr. William Barnes.

Habitat.—Durango, Colorado, May 24 to 30, June 8 to 15, July 8 to 15; Glenwood Springs, Colorado, June, July 8 to 15, 24 to 30; Yellowstone Park, Wyoming, July 8 to 15—all from Doctor Barnes.

A light-colored species with rusty-yellow or brownish shadings. In one female before me (fig. 9 on Plate 13) there is a slight tinge of olivaceous in the outer area, and in other slight respects the specimen resembles *morrisonata*, but the rusty-brown shade at once distinguishes it from that form. As in *occidentalis* this species has dentate antennæ in the male. The clasper of the genitalia is long and narrow and constricted immediately above the thumb-like projection. The scaphium hook is stout and much curved.

PERO MARMORATUS, new species.

Plate 13, figs. 10 and 11; Plate 14, fig. 14; Plate 16, fig. 9.

Expanse, 30 to 34 mm. Head and thorax chocolate brown, with or without a sparse scattering of yellowish scales. Abdomen somewhat paler, variously mottled with yellowish and light and dark shades of brown, the darker shades frequently at the posterior edge of the segments; anal brush of male light yellowish. Antennæ pale yellow below, dark brown above. A more or less pronounced whitish U-shaped mark crossing the front and connecting similarly colored spots at the base of the antennæ. Ground color yellowish-olivaceous in the male, brownish in the female. Inner line of primaries choco-

late brown, not strongly relieved from the surrounding shadings; best marked on costal area, where it appears as a broad, oblong blotch preceded by a patch of ground color; rather vaguely indicated on lower portion of wing and sometimes preceded by a narrow, broken line of ground color. Outer line brown or blackish, strongly sinuous and preceded by a rather broad, intense chocolate brown shade. Inner and median areas largely laid over with chocolate brown with a tinge of purplish, the ground color showing through in the costal portion of the wing; both areas more or less strigate with darker brown. Outer area sparsely and finely strigate in male, more profusely strigate in female, and with a dense patch of scales bordering the outer line between M_3 and Cu_2 . Other grayish-olivaceous clouds are so disposed as to leave two oblique streaks of ground color directed toward outer margin. One to three submarginal white dots between veins R_5 to M_3 and a black dot between Cu_1 and Cu_2 . Discal spot white, bordered with blackish and often composed wholly of this latter color. Fringe brown or ochereous. Secondaries purplish-brown, rather uniform in coloring and somewhat strigate, especially in outer area and at inner margin. Ground color showing only at anal angle and along inner edge. Transverse line irregular, whitish, sometimes preceded by a brown line. Three or more black spots along outer margin and a white spot between R and M_1 . Discal spot absent. Fringe as in primaries. Beneath, ground color whitish but largely suffused with warm and purplish-brown. Inner area of secondaries strigate. Cross lines of above except inner line of primaries showing as denticulate whitish lines, occasionally bordered inwardly with brown. Discal spot of primaries white, frequently marked on the inner edge with black. Discal spot of secondaries black, usually oval, occasionally divided, sometimes large, though may be reduced as to be practically absent and is then replaced by a whitish spot. Fringe as above.

Habitat.—Massachusetts and New York, southward to Virginia and westward to Illinois. Specific localities: Massachusetts: Cohasset, July 5, 10, 15, 18, 19, August 15; Newton Highlands. New York: New Windsor, July 30. New Jersey: Chester, August 4, 10. Pennsylvania: Scranton, May, July 20; Pittsburg. Maryland: Plummer's Island, April 28; Cambridge, May 24. Washington, District of Columbia. West Virginia. Illinois: Quincy, August 1 to 15; Elkhart, August 1 to 7.

Though in a degree resembling *morrisonata*, this species may be recognized at a glance by the decidedly olivaceous tint of the ground color and the clear chocolate-brown shadings. The elongated genitalia are widely different from all the other species.

Type.—Cat. No. 13126, U.S.N.M.

EXPLANATION OF PLATES.

PLATE 13.

- Fig. 1. *Pero honestarius*, male.
2. *Pero honestarius*, female.
3. *Pero giganteus*.
4. *Pero peplarioides*, male.
5. *Pero peplarioides*, female.
6. *Pero morrisonatus*.
7. *Pero behrensarius*.
8. *Pero colorado*, male.
9. *Pero colorado*, female.
10. *Pero marmoratus*, male.
11. *Pero marmoratus*, female.
12. *Pero occidentalis*.
13. *Pero modestus*.

PLATE 14.

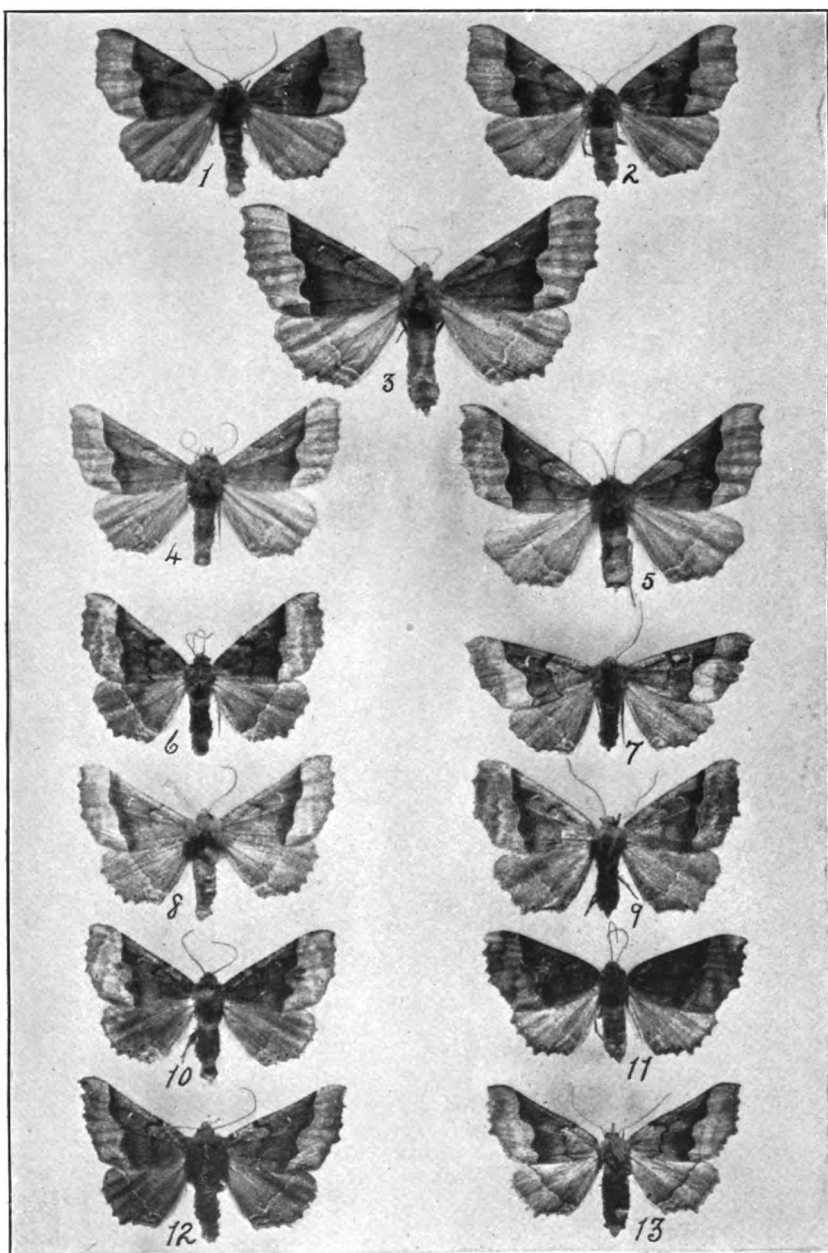
- Fig. 1. Wings of *Pero honestarius*, showing venation.
2. Venation of *P. honestarius* in the vicinity of the accessory cell, more enlarged.
3. Venation of *P. marmoratus* in the vicinity of the accessory cell, illustrating the crowding of the veins in this species.
4. Anterior leg of *P. honestarius*.
5. Middle leg of *P. honestarius*.
6. Posterior leg of *P. honestarius*.
7. Head and palpi of *P. honestarius*.
8. Section of antenna of *P. honestarius*.

PLATE 15.

- Fig. 1. Genitalia of *Pero honestarius*.
2. Genitalia of *Pero peplarioides*.
3. Genitalia of *Pero giganteus*.

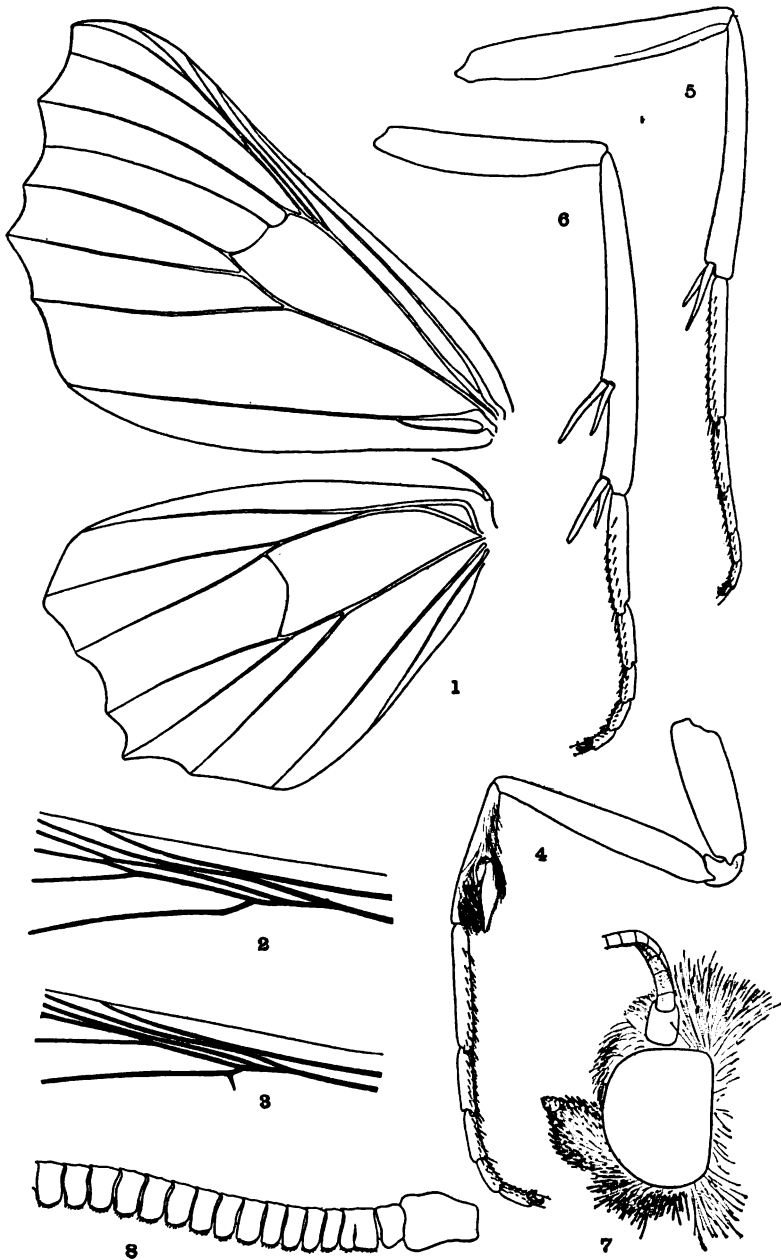
PLATE 16.

- Fig. 4. Genitalia of *Pero behrensarius*.
5. Genitalia of *Pero occidentalis*.
6. Genitalia of *Pero modestus*.
7. Genitalia of *Pero morrisonatus*.
8. Genitalia of *Pero colorado*.
9. Genitalia of *Pero marmoratus*.



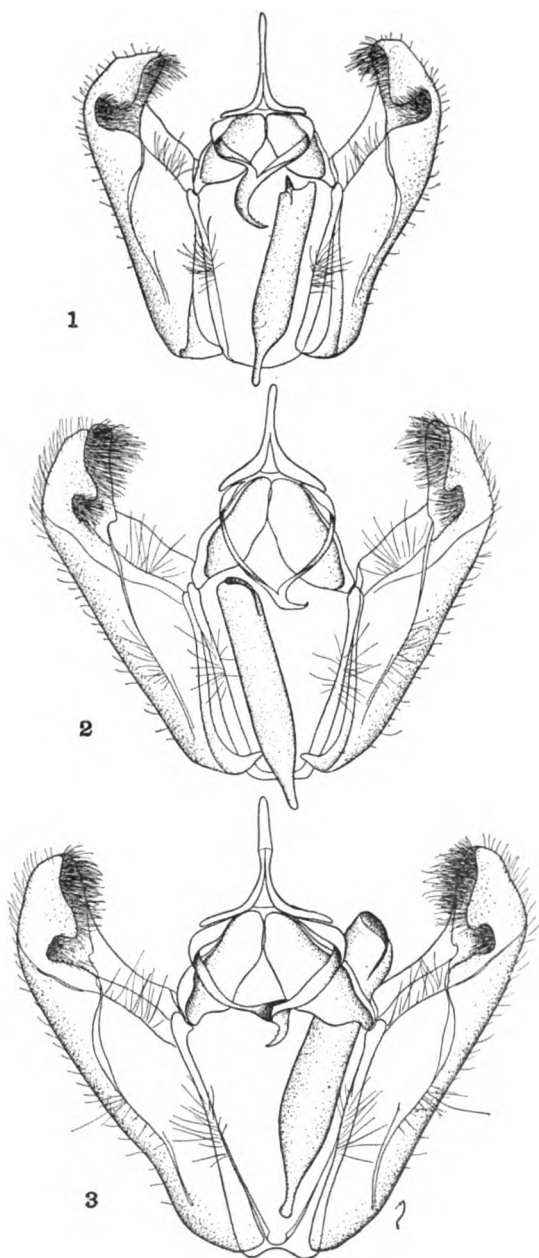
NORTH AMERICAN SPECIES OF *PERO*.

FOR EXPLANATION OF PLATE SEE PAGE 377.



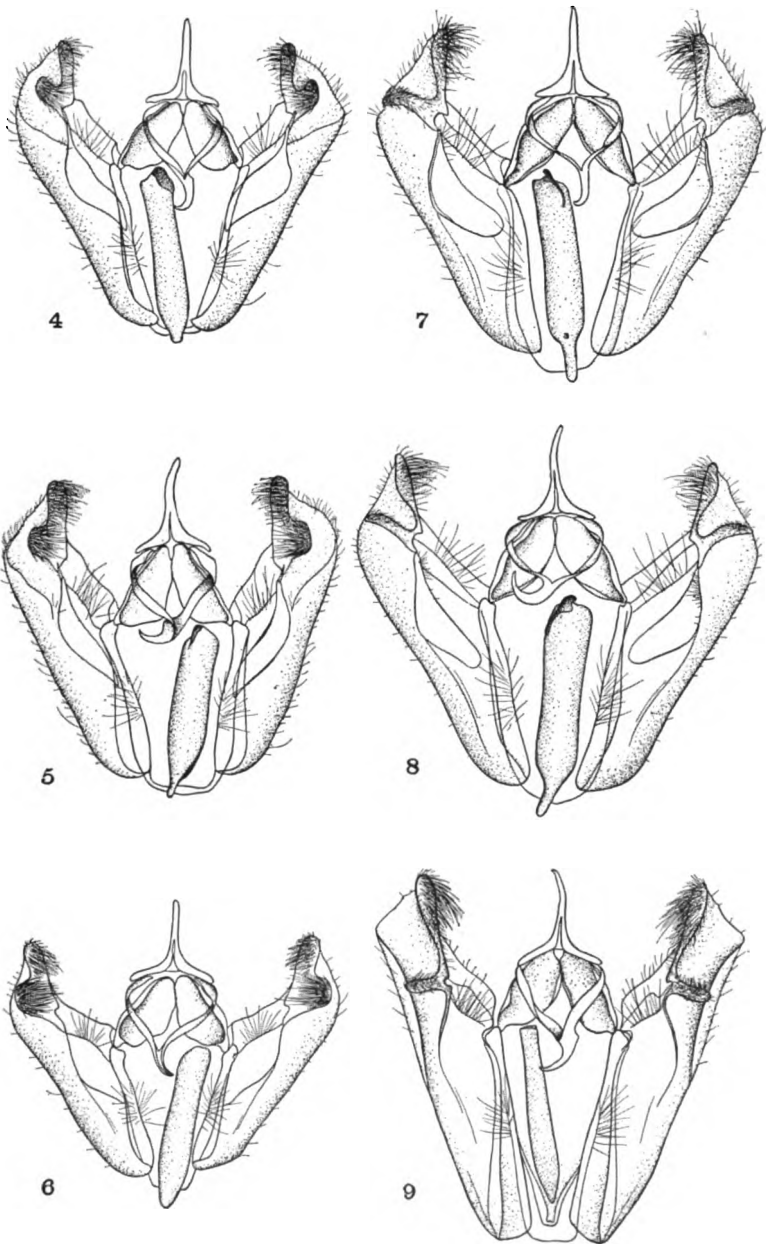
GENERIC CHARACTERS OF *PERO*.

FOR EXPLANATION OF PLATE SEE PAGE 377.



GENITALIA OF *PERO*.

FOR EXPLANATION OF PLATE SEE PAGE 377.



GENITALIA OF *PERO*.

FOR EXPLANATION OF PLATE SEE PAGE 377.

DESCRIPTIONS OF NEW SPECIES OF ICHNEUMON FLIES.

By H. L. VIERECK,

Of the Bureau of Entomology, U. S. Department of Agriculture.

The following species promise to become important economically inasmuch as they are parasitic on injurious insects. The new names are proposed at this time in order that they may be used in economic bulletins about to be published.

In the endeavor to translate habitus into word descriptions it is necessary to originate additional technical terms. Such technical terms as are used for the first time in this paper are: The *lateral ocellar line*, or the shortest line between lateral and anterior ocelli, the *post-ocellar line*, or the shortest line between the posterior ocelli, the *clype-ocular line*, or the shortest line between clypeus and eye, and the *antennocular line*, or the shortest distance between edge of antennal fossa and eye.

In this paper the term *notauli*, which is in common use among European systematists, is used instead of parapsidal furrows.

APANTELES (PROTAPANTELES) HYSLOPI, new species.

Description.—Female and male, 2 mm. long. Related to *limenitidis* from which it differs as follows: The almost rectangular oblong second dorsal plate of the gaster bounded laterally by rather deep arcuate, crenulate furrows, especially in the female; propodeum more coarsely reticulate; tegulæ, membranous edge of first dorsal segment and posterior tarsi, black or blackish; color generally darker.

This may prove to be only the Upper Sonoran representative of *Apanteles limenitidis* Riley.

Type.—Female and male, Cat. No. 13053, U.S.N.M.

Type-locality.—Pullman, Washington. Bred from *Autographa gamma*, var. *californica*, August 29, 1909, Webster No. 5903, J. A. Hyslop, collector.

Named for J. A. Hyslop.

APANTELES (PROTAPANTELES) FISKEI, new species.

Description.—Female and male, 2.5 mm. long. In size and in the shape of the first dorsal plate this resembles *Apanteles limenitidis* Riley. In the sculpture of the third dorsal plate it mostly agrees

with *Apanteles junoniæ* Riley in having the longitudinal middle third mostly longitudinally, finely rugoso-striate.

Mouth parts and legs mostly honey color, mandibles blackish at base castaneous at apex, claws dark brown, posterior tibiæ apically tinted with brown, their tarsi brownish, hind coxæ mostly black, membranous edge of first and second dorsal segments honey color, infuscated, tegulæ honey color, wings brownish.

Type.—Female and male, Cat. No. 13052, U.S.N.M.

Type-locality.—Massachusetts. Bred from *Parorgyia*, Gip. Moth Lab. No. 2620 I.

Named for W. F. Fiske.

BRACON (HABROBRACON) HOPKINSI, new species.

Description.—Female, 3 to 4 mm. long; mostly black and shining, sculptured, pubescent, the pubescence white and nowhere obscuring the sculpture. Flagel 22-jointed, mostly black like the scape and pedicel, orbits nearly completely margined with yellow, the yellow orbital band prolonged (except for a brownish break) toward the middle of the face on each side and tangent to the lower edge of the antennal fossa, another prolongation of the yellow of the orbits extending to the lower edge of the malar space and bordering the same throughout, mandibles mostly yellow, tipped with brown; posterior corner of prothorax, tegulæ, wing bases and most of legs testaceous to honey yellow, coxæ and first joint of trochanters blackish, femora basally and tibiæ apically infuscated, tarsal joints fuscous except at apices, wings transparent brownish, veins and stigma very dark brown; dorsal plate of first segment about as long as wide at apex, with an equilaterally triangular area with its apex anterior and defined laterally by foveate impressions, black, rest of dorsum of first segment yellow, second dorsal plate nearly three times as wide at apex as long down the middle, largely tectaceous medially, with an inverted U-shaped medial foveate impression, subemarginate apically, each of the following dorsal segments shorter than the one preceding, the third and fourth with a median longitudinal brownish or testaceous line, exerted portion of ovipositor apparently a little longer than the second dorsal segment.

Male.—Somewhat smaller than the female, rather slender, parallel sided; second dorsal segment mostly yellow, brown laterally and medially.

Type.—Cat. No. 12284, U.S.N.M.

Type-locality.—Summerdale, California, Hopkins No. 449c, reared September 3, 1906. (H. E. Burke.) Thirteen female paratopotypes and two male paratopotypes show only slight departures from the type. In structure and in the color of the head this species is very like *Bracon (Habrobracon) stabilis* Wesmael from England and Continental Europe.

Named for A. D. Hopkins.

RHOGAS AUTOGRAPHÆ, new species.

Description.—Female and male, 4 mm. long; compared with a specimen of *R. canadensis* Cresson, from Ottawa, this differs as follows: Face below antennæ black only medially; mesopleura and mesosternum mostly black or blackish, the lower edge of mesopleura with a border of a testaceous or ferruginous color; median longitudinal carina of first and second dorsal segments not so prominent in the female as in the male, being nearly lost among the adjoining striæ.

Type.—Female and male, Cat. No. 13054, U.S.N.M.

Type-locality.—Easton, Washington (A. Koebele).

Other locality: Pullman, Washington. Bred from *Autographa gamma*, var. *californica*, July 27, 1909, Webster No. 4595, A. J. Hyslop, collector.

HETEROSPILUS PROSOPIDIS, new species.

Description.—Very robust, thorax and abdomen each about one and one-half times as long as wide, as seen from above, brownish to yellowish in color.

Female, 4 mm. long; ovipositor 0.75 mm.; antennæ 29-jointed; notauli virtually wanting, nearly all of petiole of first discoidal cell swollen and blackish, recurrent vein received by the cubitus distinctly beyond the first transverse cubitus, propodeum coarsely reticulated, with an acute angle at base formed by raised lines starting together in the middle but terminating almost immediately beyond in the rough sculpture; first and second dorsal segments entirely longitudinally striated, the former in addition with a recurved elevated ridge on each side, the latter with a faint transverse impressed line near the apex, third dorsal segment basally longitudinally striated, only half the segment being so sculptured in the middle, more laterally, rest of the segment smooth and polished, fourth dorsal segment in the middle with the basal third longitudinally striate, laterally with more, rest of the segment smooth and polished, as are the remaining segments.

Male very like the female; antennæ 28-jointed; pseudostigma longer than wide or high and longer than the portion of the costa basad thereto.

Type.—Cat. No. 12587, U.S.N.M.

Type-locality.—Kingsville, Texas. Reared from *Bruchus* in *Prosopis juliflora*, June 6, 1909; one female and one male paratopotypes with same data as type female and male; thirty-five paratypes females, from Dallas, Texas (Hunter No. 1451, parasite of *Bruchus exiguus*), Victoria, Texas (Hunter No. 1410, parasite of *Bruchus prosopis*), (Hunter No. 1454), Forbing, Louisiana (Hunter No. 1455). These paratypes range from typical to between 1 and 2 mm. in length and in color from almost entirely castaneous to almost entirely yellowish; thirty-seven male paratypes with the same data as the female paratypes and varying in the same degree.

LIMNERIUM (ANGITIA) WEBSTERI, new species.

Description.—Clypeocular line a little longer than the antennoocular line, face rather lengthened.

Female.—4.5 mm. long; head narrowed posteriorly, lateral ocellar line about equal to the diameter of lateral ocellus, distinctly shorter or nearly half as long as the postocellar line, which latter is about one and one-half times as long as the lateral ocellar line, head black, antennæ black to blackish, mandibles mostly yellow, palpi buff; thorax, including coxæ mostly black, tegulæ, wing base, anterior and middle proximal trochanters on basal half, all distal trochanters, anterior tibiæ in front and basal sixth of middle tibiæ, all more or less yellow, apical half of anterior and middle proximal trochanters more or less brownish or fuscous,

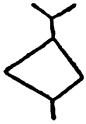


FIG. 1.—ARE-
OLETIN LIM-
NERIUM
WEBSTERI.

rest of anterior tibiæ rather testaceous, their tarsi testaceous to brownish, two middle fourths of middle and posterior tibiæ whitish on outer side, basal seventh of posterior tibiæ buff, rest of middle and hind tibiæ dark brown or fuscous, middle and posterior tarsi fuscous excepting a basal band of buff on basal joint, femora ferruginous, the hind pair brownish at base and apex, thorax hunched, speculum dull, costula complete; (figs. 1, 2) segments mostly black, postpetiole behind spiracles as long as wide and with a narrow apical honey-colored band, plica yellowish, second dorsal segment with a narrow subapical honey-colored band, its thyridia indistinct, a little more removed from the lateral edge of the pigmented plate than the spiracles, third, fourth, and fifth dorsal segments apically and laterally with a more or less testaceous patch, exerted portion of ovipositor about as long as the second dorsal segment.

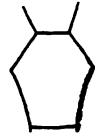


FIG. 2.—AREOLA
IN LIMNERIUM
WEBSTERI.

Type.—Cat. No. 13055, U.S.N.M.

Type-locality.—Pullman, Washington, August 14, 1909. Bred from *Autographa gamma*, var. *californica*, Webster No. 4595, J. A. Hyslop, collector.

Named for F. M. Webster.

LIMNERIUM (HYPOSOTER) PARORGYLÆ, new species.

Description.—Clypeocular line equal to the antennoocular line; face rather transverse not appearing lengthened; abdomen club-shaped or thickened in the middle, not slender; other subgeneric characters very as in *Anilastus* (Førster) Thomson.

Female.—7 mm. long; head and thorax black excepting the appendages, abdomen mostly reddish; lateral ocellus as far from the eye as from the anterior ocellus, the lateral ocelli one and one-half times as far from each other as from the anterior ocellus, clypeus

subtruncate, almost arcuate, the lateral suture represented only by a slight difference in sculpture, the spiracle indistinct, almost obsolete, mandibles yellow excepting the teeth, which are castaneous, palpi yellow, scape dark brown with pale edge at apex, rest of antennæ blackish, second joint of flagel two-thirds as long as the first; tegulæ, base of wings, trochanters of anterior and middle legs, anterior femora at tip, anterior tibiæ externally, middle tibiæ externally, and anterior and middle metatarsi yellow or yellowish, rest of anterior and middle legs honey color, more or less tinted with brownish, excepting the femora, which are inclined to reddish, anterior coxæ yellow, brownish at base, middle coxæ brownish, posterior coxæ mostly blackish, partly reddish brown, posterior trochanters blackish, their femora reddish, their tibiæ testaceous with a subbasal fuscous band as wide as the tibia is thick at base, their tarsi testaceous, paler than the tibiæ, spurs whitish or honey color, claws brown, areolet petiolate; (fig. 3) abdomen reddish except the narrow portion of petiole which is blackish, second dorsal segment with indistinct thyridia that adjoin the lateral edge and are one-eighth the distance from the base and are nearly one-fourth as wide as the segment is at base, spiracles of this segment nearly adjoining the lateral margin and a little beyond the middle, plica honey color to testaceous, sheaths of the ovipositor blackish, clavate, ovipositor hidden when at rest, narrow portion of dorsum of petiole not grooved on the sides.



FIG. 3.—AREO-PETIOLAREA IN *LIMNERIUM PARORGYZÆ*.

Male.—Very like the female; middle coxæ honey color, hind trochanters more or less testaceous, clypeus anteriorly testaceous, areopetiolarea not distinctly transversely rugose.

Type.—Cat. No. 13035, U.S.N.M.

Type-locality.—Massachusetts. (Gip. Moth Lab. 1471 A., 1471 B., 2619 A.)

As shown by a paratopotype, the middle coxæ may be blackish, the basal fuscous band of hind tibiæ almost missing, and the rugæ of areopetiolarea not be arranged so as to make it appear that the areola is separated from the petiolarea.

Subgenus *HYPOSOTER* Förster.

Type.—*Limnerium (Hyposoter) parorgyziæ* Viereck.

Subgenus *ANILASTUS* Förster.

Type.—*Campoplex rapax* Gravenhorst.

ICHNEUMON (CRATICHNEUMON) BURKEI, new species.

Description.—In color this agrees with the description given for *I. sublatius*, var.^a excepting in the metathorax which in our species is entirely black behind.

^a Trans. Amer. Ent. Soc., vol. 6, 1877, p. 137.

Male.—Twelve to thirteen mm. long. Stature and pubescence such as to remind one of *Arenetra ventralis* Cresson. Metapleura separated into two parts by an arcuate carina, juxta-coxal area therefore defined. Scape rather discus shaped. Areola in outline nearly as in *Barichneumon* as figured by Morley,^a but more rounded anteriorly. Ninth to fourteenth joints of flagel more or less yellowish on one side, meso and meta pleura maculated with yellow.

Type.—Cat. No. 12701, U.S.N.M.

Type-locality.—Wisconsin. Reared by H. E. Burke from a Liparid on *Pinus* (Hopkins U. S. 8389 d').

This may prove to be the presumably undescribed male of *I. otiosus* Say.

Named for H. E. Burke.

^a Ich. Brit. Ichneumoninae, 1903, p. 41.

A NEW CARNIVORE FROM CHINA.

By GERRIT S. MILLER, Jr.,

Curator, Division of Mammals, U. S. National Museum.

Among some mammals collected by Mr. Arthur de C. Sowerby in northwestern China and the Ordos Desert are two skins of a spotted polecat readily distinguishable from the western *Vormela*^a *peregrusna*^b by a peculiar inversion of the color pattern of back. Regarding the history of the specimens Mr. Sowerby writes: "The larger skin was brought to me in a very poor condition. The skull was missing, as were also the leg bones, while the tail was torn in two, and one eye was torn. I offered large rewards for a complete specimen, but though several Mongols and Chinese were induced to enter the Ordos in search of them, I obtained nothing more than a small dry skin which accompanies the above-mentioned specimen. From what I could gather the animal is not at all common. It frequents spots where trees exist, and climbs freely. The Chinese name 'Ma-nai-ho' would also signify this fact, the last syllable 'ho' meaning monkey or ape. They are sometimes caught in traps set for foxes. Their skin, however, has no market value. They are very savage when caught. The above facts were given and confirmed repeatedly by natives who had traded in the Ordos."

VORMELA NEGANS, new species.

Plate 17.

Type-specimen.—Adult male (skin only), Cat. No. 155001, U.S.N.M. Taken by natives in the Ordos Desert about 100 miles north of Yu-ling-fu, Shensi, China. Original No. 92.

^a 1884. W. Blasius, Ber. Naturf. Ges. Bemberg, vol. 13, p. 9. Distinguished from the true polecats by the presence of a well-developed metaconid in lower carnassial and by the contact of hamular process with audital bulla.

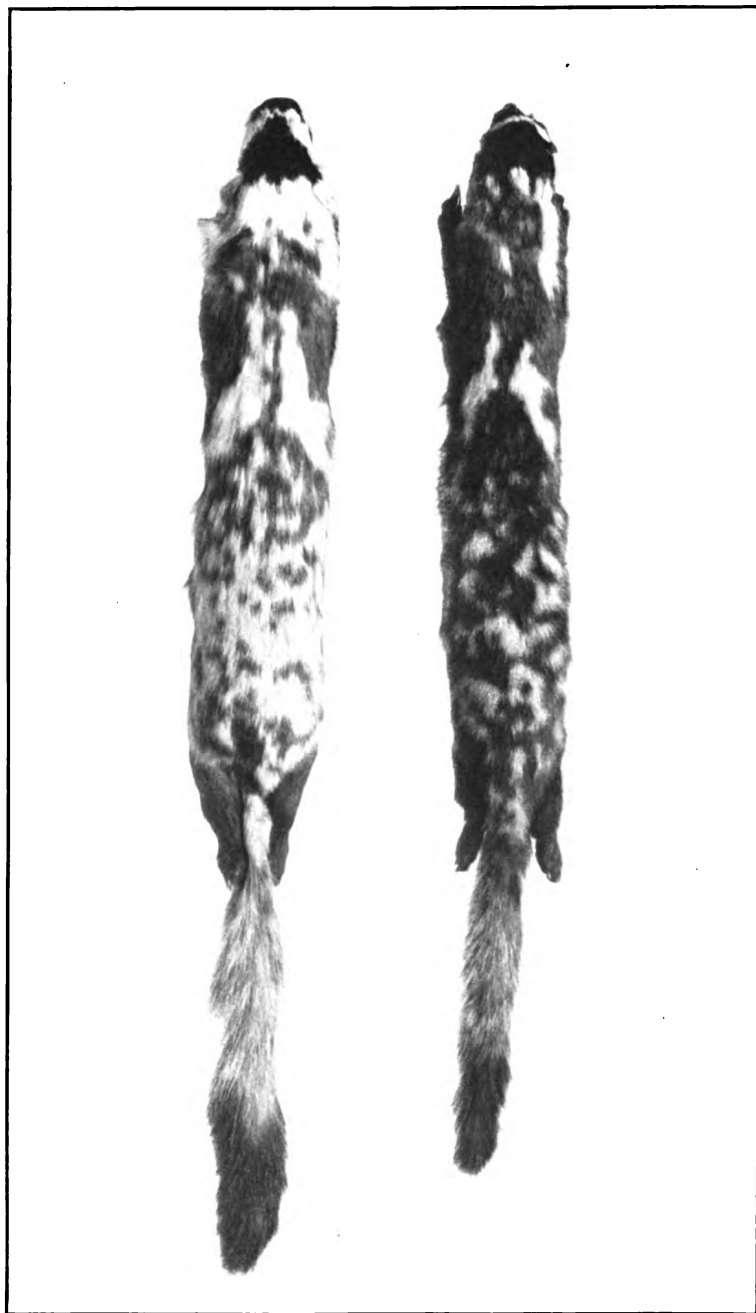
^b 1770. *Peregrusna*, nova *Mustela* species, Guldenstaedt, Nov. Comm. Akad. Imp. Petrop., vol. 14, p. 441 (Banks of the River Don, southern Russia).

1771. *Mustela sarmatica* Pallas, Reise Russ. Reichs, vol. 1, append., p. 453 (near mouth of the Volga, southern Russia).

Diagnosis.—Like *Vormela peregusna* but light markings paler and more extensive, those on posterior half of back confluent, so that this region is yellow mottled with brown instead of brown mottled with yellow; underparts, forelegs, and inner surface of hindlegs black instead of dark brown.

Measurements.—Type (from skin, apparently not much stretched): Head and body, 340 mm.; tail, 210.

Specimens examined.—Two, both from the Ordos Desert.



1

2

1. *VORMELA NEGANS*, TYPE. ORDOS DESERT. 2. *VORMELA PEREGUSNA*. DOBRUDSCHA.

FOR EXPLANATION OF PLATE SEE PAGE 385.

PROISOCRINUS, A NEW GENUS OF RECENT CRINOIDS.

By AUSTIN HOBART CLARK,

Assistant Curator, Division of Marine Invertebrates, U. S. National Museum.

The work of the U. S. Bureau of Fisheries steamer *Albatross* among the Philippine Islands has just brought to light one of the most interesting species of recent stalked crinoids yet discovered. It is not certain whether the new genus which it represents should be referred to the Apiocrinidæ or to the Pentacrinitidæ; the general structure of the calyx and arm bases is that of *Bathycrinus*; of the arms and pinnules that of the Pentacrinitidæ; of the proximal part of the stem that of the Pentacrinitidæ, but of most of the stem that of *Calamocrinus*. Its resemblance to certain species of *Millericrinus*, in particular to *M. nodotianus*, is undoubtedly more than superficial, and it is quite possible that it should be considered as congeneric with them. In general terms it may be said to hold exactly the same relation to the Pentacrinitidæ as *Thiolliericrinus* does to the Comatulida.

The height of this new form without the root is somewhat over 40 inches, so that it is much the tallest recent fixed crinoid yet discovered. Its color is a vivid scarlet, midway between the purple or green of the Pentacrinitidæ and the yellow of the Apiocrinidæ and Bourgueticrinidæ in significance.

The new genus may be known as

PROISOCRINUS, new genus.

The characters of this genus are included with those of the single species which it contains.

Genotype.—*Proisocrinus ruberrimus*, new species.

PROISOCRINUS RUBERRIMUS, new species.

The stem is 843 mm. in length,^a and contains 442 columnars; it is broken at the base, but was undoubtedly firmly fixed by a large root, probably like that of *Phrymocrinus* or *Calamocrinus*.

The upper part of the stem (fig. 1) is 6 mm. in diameter; it is composed of pentalobate columnars, generally alternating in size, but

^a The total length of the entire animal is 1 meter, 18 millimeters.

showing intercalated columnars in all stages of growth, and at intervals

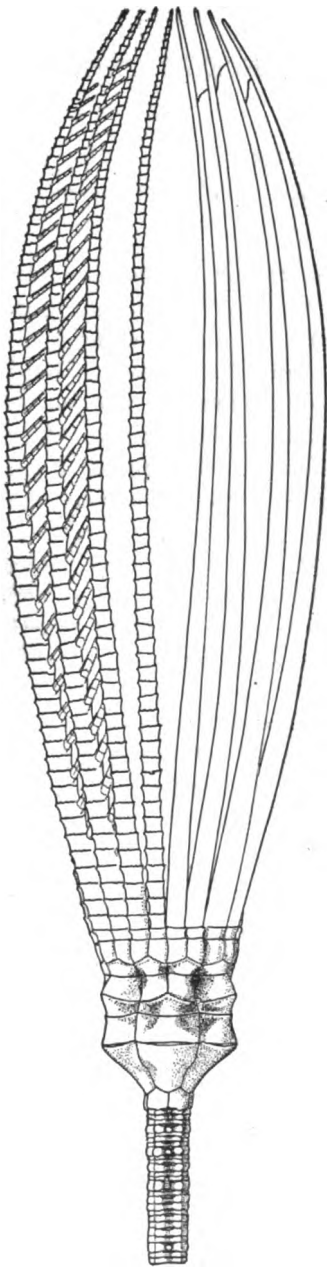


FIG. 1.—*PROISOCCRINUS RUBERRIMUS*;
CROWN AND UPPER PART OF COLUMN;
FROM THE TYPE.

a large nodal bearing five cirri. The interval between these nodals rapidly increases as a result of extensive intercalation of new columnars; correlatively the nodals progressively lose their individuality (fig. 2), the cirri, which are never more than rudimentary, drop off, and the nodals become indistinguishable from the other segments. The ten internodes possess the following numbers of columnars, the first being that just beneath the basals: 1 (intercalated), 1 (intercalated), 3 (2 intercalated), 4 (3 intercalated), 5, 8, 14, 25 (there are no cirri at this nodal and the cirrus sockets are partially obliterated), 38 (all of the same size; the difference between this nodal and the internodes above it is not great; the cirrus sockets are indistinct); 38 (all of the same size; the nodal is scarcely distinguishable from the columnars on either side of it, and the cirrus sockets can only just be made out); this last nodal is 151 mm. from the crown (fig. 2); below this point the stem is cylindrical, 5 mm. in diameter (having decreased in diameter very gradually as the segments lost their pentalobate outline), each segment being 1.5 mm. high, and all of equal size; the ends show a depressed central area surrounded by a rim about 1.5 mm. broad with 15 coarse radial crenellæ (fig. 3); distally the stem very slowly increases in diameter, the broken end being 11 mm. across; the last few columnars are 3.5 to 4 mm. in height. As the distalmost part of the stem enlarges with slightly greater rapidity than the remainder, the stem was undoubtedly broken off close to the root. The cirri are all

broken; but they appear never to have exceeded 5 mm. in length.

Basals 5, equal in size, broadly pentagonal, 3.6 mm. broad and 3.7 mm. high, the anterior apex forming an angle of about 120° (fig. 1); the basal circlet has a diameter of about 6.4 mm.; its outer sides are parallel with the dorso-ventral axis of the animal.

Radials large, trapezoidal, the dorsal surface 7.5 mm. long and 9 mm. in maximum (distal) width; the outer sides of the radial circlet make an angle of about 45° with the dorso-ventral axis of the animal.

The primibrachs are very closely united, apparently by syzygy; the first primibrach occupies proximally the entire distal border of the radials; it is approximately oblong, with moderately concave distal and convex proximal edges, and straight lateral edges which are entirely free, but are in close apposition with those of the neighboring first primibrachs, and are sharply flattened. The median length is 3.7 mm., the lateral length 3.5 mm.; the second primibrach (axillary) is considerably smaller than the first, but of equal width; it is 3.3 mm. in median and 2 mm. in lateral length; the anterior angle is rather obtuse; the outer edges of the primibrachs are parallel with the dorso-ventral axis of the animal.

The secundibrachs are two in number, united by syzygy like the primibrachs; the first is much larger than the second, and is in close apposition with its fellow interiorly, though not united to it.

The twenty arms are 155 mm. long, moderately slender; the first brachial is large, approximately square in external view; the second brachial is united to the first by syzygy; it is oblong, about twice as broad as long, and about one-half the size of the first; the following brachials are approximately square, with concave sides and slightly projecting and spinous distal ends, becoming longer than broad distally; the terminal ten or twelve brachials bear no pinnules. There are no brachial syzygies.

The pinnules are not very different from those of the pentacrinites, but the lower segments have produced and strongly denticulate edges, this dying away

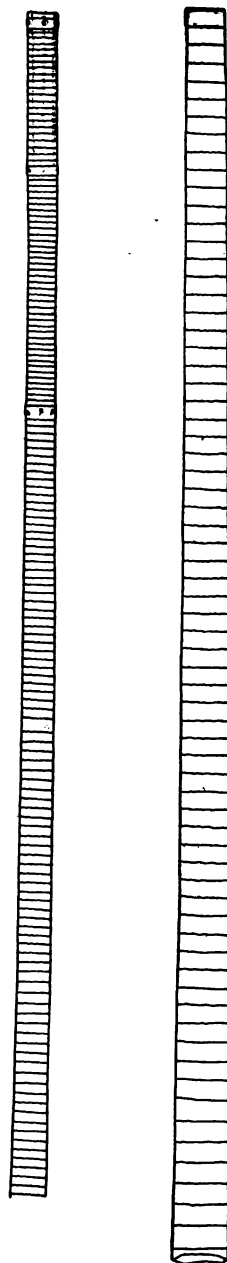


FIG. 2.—PROISOCRINUS BERRIMUS; PROXIMAL AND DISTAL PORTION OF COLUMN.

gradually in the outer half of the pinnules; there are large covering plates, but no definite side plates. The pinnules are 17 or 18 mm. long in the middle and outer part of the arm, somewhat shorter proximally; the first pinnule is on the second brachial.

Color (in life).—"Brilliant uniform scarlet" (F. M. Chamberlain).

Type-specimen.—Cat. No. 24308, U.S.N.M., from *Albatross* station 5439.

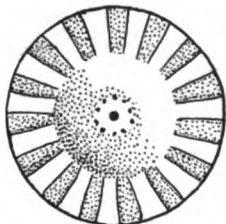


FIG. 3.—ARTICULAR FACE OF A COLUMNAR FROM ABOVE THE MIDDLE OF THE STEM.

The genus *Proisocrinus* is most nearly related to *Carpenterocrinus*, a genus which I created not long ago for the reception of the curious species called by Carpenter *Pentacrinus mollis*. This species is very imperfectly known, the type and only known specimen being a mutilated calyx with a few columnars attached which is now in the British Museum. The characters which it

presents appear to warrant generic differentiation from *Proisocrinus ruberrimus*, though undoubtedly the two are closely allied. It is interesting to note that both in *Carpenterocrinus* and *Proisocrinus* one of the rays is smaller than the other four.

DESCRIPTIONS OF TWO NEW GENERA AND SIXTEEN NEW SPECIES OF MAMMALS FROM THE PHILIPPINE ISLANDS.

By GERRIT S. MILLER, Jr.,

Curator, Division of Mammals, U. S. National Museum.

Of the sixteen new Philippine mammals described in this paper, thirteen are contained in a large collection made by Dr. Edgar A. Mearns during the years 1905 to 1907, and now in the United States National Museum. The three others form part of a collection submitted to me for determination by the authorities of the Philippine Bureau of Science.

CROCIDURA HALCONUS, new species.

Type-specimen.—Young adult female (skin and skull), Cat. No. 144652, U.S.N.M. Collected on spur of main ridge of Mount Halcon, Mindoro (altitude 6,300 feet), November 18, 1906, by Dr. Edgar A. Mearns. Original number, 6316.

Diagnosis.—Like *Crocidura grayi* Dobson of Luzon, but with unicuspid teeth much more contrasted in size.

Color.—Entire animal dark sepia, blackening on posterior half of back, the underparts tinged with broccoli-brown; feet and tail blackish, the long hairs on tail a slightly contrasted brown.

Skull.—The skull does not differ appreciably from that of *Crocidura grayi*, though the interorbital region seems inclined to be narrower and the braincase less deepened than in the Luzon animal. The size and general appearance of the skull is also very similar to that of the European *Crocidura russula*; but the Philippine species are at once distinguishable from *russula* and its near allies by their greater depth of skull, a difference readily appreciable when the braincases are compared in posterior view.

Teeth.—On comparison of specimens of *Crocidura grayi* and *C. halconus* with perfectly unworn teeth it is immediately seen that there is much more contrast in size among the upper unicuspid teeth of the Mindoro animal. This appears to be due to a slight increase in the size of the first and a reduction in the size of the second, the third remaining unchanged. Though especially noticeable in lateral view, these pecul-

iarities are also appreciable in the outlines of the crowns. The large premolar and first molar also exceed the corresponding teeth in *C. grayi*.

Measurements.—Type: Head and body 74 mm.; tail, 54; hind foot (dry), 13; skull (teeth not worn), condylobasal length, 19.0; breadth of braincase, 9.0; depth of braincase at middle, 5.0; mandible, 10.2; maxillary tooththrow (entire), 8.8; mandibular tooththrow (entire), 8.2.

Specimens examined.—Four, all from the type-locality.

CROCIDURA BEATUS, new species.

Type-specimen.—Adult male (skin and skull), Cat. No. 144647, U.S.N.M. Collected on summit of Mount Bliss (altitude 5,750 feet), Mindanao, May 28, 1906, by Dr. Edgar A. Mearns. Original number, 6173.

Diagnosis.—Similar to *Crocidura grayi* and *C. halconus*, but color darker and skull slightly less robust.

Color.—The elements of the color are the same as in *Crocidura halconus*, but the blackish suffusion on back is more extensive, involving nearly the entire dorsal surface.

Skull and teeth.—Except that it is less robust, a peculiarity not appreciable except on direct comparison, the skull resembles that of the other small Philippine *Crociduras*. The teeth in the type are somewhat injured, but they apparently resemble those of *C. halconus*.

Measurements.—Type: Head and body, 77 mm.; tail, 55; hind foot (dry), 14.4; skull (teeth slightly worn), condylobasal length, 19.2; breadth of braincase, 9.0; depth of braincase, 5.0; mandible, 10.4; maxillary tooththrow (entire), 8.8; mandibular tooththrow (entire), 8.2.

Specimen examined.—The type.

CROCIDURA MINDORUS, new species.

Type-specimen.—Young adult male (skin and skull), Cat. No. 144654, U.S.N.M. Collected on summit of main ridge of Mount Halcon (altitude 6,300 feet), Mindoro, November 19, 1906, by Dr. Edgar A. Mearns. Original number, 6321.

Diagnosis.—Color and general appearance as in *Crocidura grayi* and its allies, but size noticeably greater; hind foot about 16 mm. instead of about 13 mm., condylobasal length of skull about 22 mm. instead of about 19 mm.

Color.—The color so exactly resembles that of *Crocidura halconus* and *C. grayi* as to need no special description. The blackish suffusion on back is, however, apparently a little less evident than in *C. halconus*.

Skull and teeth.—Though at once distinguishable by its conspicuously larger size the skull shows no peculiarities of form as compared

with that of *C. grayi*. Teeth essentially as in the smaller Philippine species, but second and third unicuspid more nearly equal in size, the discrepancy scarcely noticeable in side view, though the crown area is rather notably greater in third than in second.

Measurements.—Type: Head and body, 91 mm.; tail, 72; hind foot (dry) 16.4; skull (teeth slightly worn), condylobasal length, 21.6; breadth of braincase, 10.0; depth of braincase, 5.8; mandible, 12.0; maxillary tooththrow (entire), 9.8; mandibular tooththrow (entire), 9.0.

Specimen examined.—The type.

CROCIDURA GRANDIS, new species.

Type-specimen.—Adult male (skin and skull), Cat. No. 144648, U.S.N.M. Collected on Grand Malindang Mountain, Mindanao (altitude, 6,100 feet), June 3, 1906, by Dr. Edgar A. Mearns. Original number, 6181.

Diagnosis.—Like *Crocidura mindorus* but larger; hind foot 19.5 (18.6), condylobasal length of skull about 23 mm.

Color.—Though essentially like that of *Crocidura mindorus* the color differs from that of the other Philippine members of the genus in the presence of a slight but evident slaty tinge throughout the pelage. The exact shade is perhaps best described as intermediate between hair-brown and mouse-gray but darker than either; feet and tail an indefinite dark brown obviously different from the blackish of the same parts in the other species.

Skull and teeth.—Aside from its larger size the skull resembles that of *C. mindorus*. Second unicuspid distinctly smaller than third. Teeth otherwise as in the related large species.

Measurements.—Type: Head and body, 95 mm.; tail, 67; hind foot, 18.6; skull (teeth slightly worn), condylobasal length, 23.0; breadth of braincase, 10.2; depth of braincase, 6.0; mandible, 12.8; maxillary tooththrow (entire), 10.2; mandibular tooththrow (entire), 9.4.

Specimen examined.—The type.

TUPAIA CUYONIS, new species.

Type-specimen.—Adult male (skin and skull), No. 26, P.B.S. Collected on the Island of Cuyo, January 15, 1903, by R. C. McGregor and A. Celestino.

Diagnosis.—In general like *Tupaia möllendorffi* Matschie, but underparts a grizzled buffy-brown scarcely different from color of sides.

Color.—Upperparts and sides a fine nearly uniform grizzle of black and buff, the shorter hairs slate-gray at base (5 mm.), then light buff (3 mm.), black (2 mm.), brownish buff (1 mm.), and black (the extreme tip), the longer hairs without the brownish-buff annulation, the general effect something between wood-brown and clay-color, with a greenish cast on back and shoulders and a tinge of russet on sides, flanks, and rump; face and crown with hairs shorter and more

finely grizzled than those of neck; shoulder stripe ill-defined (in some specimens practically absent), light buff; underparts a brownish buff, tinged with ochraceous posteriorly and with dull cream buff on chest and throat, the slate-gray bases of the hairs appearing irregularly at surface and producing a slight grizzled appearance so that the general effect is not noticeably different from that of sides; feet slightly paler than back, the actual color an indefinite brownish buff; tail essentially like back above but more coarsely grizzled and slightly paler, the hair dark at extreme base and at tip, the median portion with four buff and three blackish annulations, below with median region a nearly clear brownish buff essentially like that of feet.

Skull and teeth.—The skull and teeth do not differ appreciably from those of *Tupaia möllendorffi*. As in the Culion animal the skull essentially resembles that of *Tupaia ferruginea* except for its smaller size, and the hypocone of m^1 and m^2 tends to be less developed than in the larger species.

Measurements.—Type: Head and body, 154 mm.; tail, 166; hind feet (dry), 39.6; skull (teeth moderately worn), condylobasal length, 43.0; zygomatic breadth, 24.4; breadth of braincase, 17.8; mandible, 31.0; maxillary toothrow (alveoli), 23.6; mandibular toothrow (alveoli), 19.4. Average and extremes of nine adults: Head and body, 156.4 (145–166); tail, 163.3 (152–175); hind foot, 39.9 (39–40.6).

Specimens examined.—Nine, all from the island of Cuyo.

PTEROPUS PUMILUS, new species.

Type-specimen.—Adult male, teeth slightly worn (skin and skull). Cat. No. 144758, U.S.N.M. Collected on Palmas Island, southeast of Mindanao, January 21, 1906. Original number, 6019.

Diagnosis.—Essentially like *P. speciosus* Andersen, from Malanipa Island off the southwest point of Mindanao, but with smaller skull, feet, and claws.

Color.—Body hair-brown or broccoli-brown, the back irregularly suffused with dull, light buff, the underparts tinged with ochraceous; mantle and head dull buff, the middle of neck both above and below strongly suffused with light ochraceous; face, chin, and interramia inconspicuously sprinkled with dark-brown hairs.

Skull and teeth.—Aside from their smaller size the skull and teeth agree with those of *Pteropus speciosus*.

Measurements.—Type: Forearm, 109 mm.; third finger, 199; skull (teeth slightly worn); condylobasal length, 49.8 (56.6);^a zygomatic breadth, 29.6 (30.0); mastoid breadth, 16.6 (19.0); breadth of braincase, 19.6 (20.4); postorbital constriction, 7.8 (7.6); interorbital constriction, 7.2 (7.2); depth of braincase at middle, 17.8 (19.2);

^a Cranial measurements in parentheses are those of an adult female topotype of *P. speciosus* (teeth moderately worn), Cat. No. 144743, U.S.N.M.

mandible, 39.2 (45.2); maxillary toothrow (exclusive of incisors), 18.2 (21.2); mandibular toothrow (exclusive of incisors), 21.0 (23.8).

Specimens examined.—Two, both from Palmas Island.

CHILOPHYLLA, new genus (Hipposideridae).

Type.—*Chilophylla hirsuta*, new species.

Characters.—Noseleaf consisting of an ill-differentiated horseshoe and lancet, the former produced anteriorly as a pair of conspicuous lappets separated by a deep median sinus and projecting noticeably beyond margin of upper lip, each lobe formed largely by an elongated supplemental leaflet which continues forward the outline of the obliquely truncate horseshoe proper; the upper lip very low, much less noticeable than lappets, with small upright median process and two ill-defined cross-flutings; nostril at inner border of a pit, the raised edges of which form a somewhat diamond-shaped figure; a freely projecting ligulate process at outer corner of diamond; a projecting wart within pit directly over opening of nostril; space between nostrils occupied by a freely projecting, somewhat bilobate process, rather broader than high (faintly suggesting a rudimentary "sella" without connecting process); below this process is another, somewhat smaller and deeply bilobate, each lobe connected by a ridge with inner edge of corresponding lappet of horseshoe; a low slightly curved ridge above nostril at a distance about equal to vertical diameter of diamond; outer extremity of this ridge approaching, but not actually reaching, a wart-like excrescence situated near margin of horseshoe; ear very large, the inferior lobe greatly developed and producing a funnel-like general form, the substance of ear everywhere thin and pellucid, with no trace of ridges in region of meatus. Thumb with metacarpal about one-fourth as long as that of third finger, the phalanges and claw short, their combined length only about one-third that of metacarpal; leg and foot slender, but with no special peculiarities of form; calcar reduced to a mere tubercle; wing membrane inserted at ankle; antebrachial membrane extending outward as a broad fold to include entire metacarpal of thumb, its width so great as to form a conspicuous pouch at bases of metacarpals; interfemoral membrane narrow, barely extending to rudimentary calcar; tail very short, its length about half that of femur. Skeletal and dental characters not known.

CHILOPHYLLA HIRSUTA, new species.

Plate 18.

Type-specimen.—Adult female (skin only^a), Cat. No. 144821, U.S.N.M. Collected on Alag River opposite mouth of Egbert River,

^a The entire body was preserved in alcohol but I have thus far been unable to find it among Doctor Mearns' Philippine specimens.

Mindoro, December 2, 1906, by Dr. Edgar A. Mearns. Original number, 6337.

Diagnosis.—A small, delicately formed bat with very large, funnel-shaped ears and unusually long soft fur; noseleaf inconspicuous except for the two lappets projecting over upper lip, its median portion essentially bare, its margins densely haired, especially at sides; general color light brown.

External characters.—The more important external characters have been described in the account of the genus. Fur long and loose, the hairs at middle of back about 11 mm. in length, those on belly about 7 mm. in length. On wing membranes the fur extends to a line joining middle of humerus with basal third of femur. Ear thickly sprinkled on both surfaces with loosely spreading hairs, those along inner border about 4 mm. in length. Hairs on edge of noseleaf and on neighboring portion of muzzle radiating stiffly outward, the longest, near middle of noseleaf, about 5 mm. in length.

Color.—Entire animal a uniform light brown, between the wood brown and fawn color of Ridgway, the middle of belly faintly tinged with light buff at tips of hairs; under color very dark brown with a slaty tinge; ears translucent light brown; membranes an indefinite dark brown.

Measurements.—Head and body, 33 mm.; tail, 7; femur, 14.2; tibia, 13.6; foot, 6.4; forearm, 33.8; thumb, 8.2, its metacarpal, 6.2; second finger, 32; third finger: metacarpal, 24.2, first phalanx, 6.2, second phalanx, 22; fourth finger: metacarpal, 25.4, first phalanx, 7.8, second phalanx, 8.6; fifth finger: metacarpal, 27.4, first phalanx, 8.4, second phalanx, 10.2; ear from meatus, 12; ear from crown, 10; ear from extreme lower margin, 16; greatest width of ear, 11.6; greatest length of noseleaf, 8.2; greatest width of horseshoe, 5.2; height of lancet above muzzle, 2.2; length of free portion of lappet, 2.

Specimen examined.—The type.

TAPHOZOUS PLUTO, new species.

Type-specimen.—Adult female (skin and skull), Cat. No. 144812, U.S.N.M. Collected at Mercedes, 9 miles east of Zamboanga, Mindanao, March 28, 1906, by Dr. Edgar A. Mearns. Original number, 6054.

Diagnosis.—Similar to *Taphozous saccolaimus* Temminck of Java, but smaller; adult female; forearm 69 to 72 mm. instead of 74 to 76 mm., condylobasal length of skull about 21 mm. instead of about 23 mm.

Measurements.—Type: Forearm, 71.4 mm.; third finger, 116; fifth finger, 67; tibia, 25.5; foot 17.3; skull, condylobasal length (to front of alveolus of canine) 21.2 (23.0);^a zygomatic breadth, 15.8

^a Measurements in parentheses are those of an adult female *Taphozous saccolaimus* from Buitenzorg, Java (Cat. No. 154609, U.S.N.M.).

(16.8); mastoid breadth, 13.2 (14.0); breadth of brain case, 11.0 (11.2); postorbital constriction, 5.0 (5.0); interorbital constriction, 8.0 (8.8); mandible, 18.6 (19.8); maxillary tooth row, 10.6 (11.2); mandibular tooth row 12.0 (12.8).

Specimens examined.—Three, one from Mindanao, the others from Pandon, Albay, Luzon (collected by D. B. Mackie).

EPIMYS TYRANNUS, new species.

Plate 19.

Type-specimen.—Adult male (skin and skull), No. 8, P. B. S., Ticao, May 15, 1902. R. C. McGregor and A. Celestino, collectors.

Diagnosis.—Size essentially as in *Epimys imperator* Thomas, of the Solomon Islands, the largest known member of the genus, but skull not differing conspicuously from that of *Epimys norvegicus* in form.

External character.—General external form, including size of ear, relative lengths of tail and head and body, lengths of palm and sole, of digits, and claws, about as in *Epimys norvegicus*. Tail essentially naked, sparsely sprinkled with stiff hairs about 2 mm. in length which nowhere form any approach to a hairy covering; annulations well defined, about 7 to the centimeter at middle of tail, their distal margins closely appressed. Palm and sole naked, the tubercles essentially as in *Epimys norvegicus*, but slightly larger in proportion to area of region which they occupy; a small but well-developed secondary wart at outer side of the plantar tubercle at base of both first and fifth toes; postero-external plantar tubercle long, its greatest diameter about $2\frac{1}{2}$ times that of sixth. Fur coarse, harsh, and stiff, though nowhere actually spinous; the underfur thin, the longer hairs for the most part slender grooved bristles, those of middle of back about 15 mm. in length; rump and lumbar region with rather conspicuous growth of coarse terete hairs about 60 to 75 mm. long.

Color.—Whole animal a dull indefinite brown somewhat intermediate between the wood brown and broccoli brown of Ridgway, the median dorsal region from between eyes to base of tail with a darker tinge (about Mars brown), the sides of shoulders suffused with drab, the underparts tinged with dull buff; a faintly indicated dark area around eyes; cheeks and muzzle dull fawn color; whiskers black in rather noticeable contrast; feet a dull, indefinite brown not contrasting with body; tail blackish through basal half, then whitish to tip.

Skull.—Except for its much greater size the skull does not differ conspicuously from that of *Epimys norvegicus*. Supraorbital bead well developed, perhaps relatively higher than in *Epimys norvegicus*, continued backward as a conspicuous lateral ridge along side of brain case to outer margin of interparietal, where it joins lambdoid crest; lateral ridges converging posteriorly, the distance between them at point of crossing suture between frontal and parietal greater

than that at outer borders of interparietal, a condition the reverse of that in *Epimys norvegicus*. Suture between premaxillary and maxillary relatively further forward in front of antorbital foramen than in *Epimys norvegicus*.

Teeth.—The teeth in the only known specimen are slightly too worn to show the exact details of the enamel folding. In general they appear to represent a stage of reduction of the outer side of upper molars corresponding to that of *Epimys rattus*. Fourth tubercle in both m^1 and m^2 with distinct outer reentrant angle.

Measurements.—Type: Head and body, 310 mm.; tail, 270; hind foot (dry), 57 (53.6); skull, condylobasal length, 62.2; nasal, 28.0; diastema, 19.6; zygomatic breadth, 31.0; mastoid breadth, 24.2; greatest breadth across lateral ridges, 16.8; breadth across lateral ridges posteriorly, 12.8; interorbital constriction, 9.6; depth of braincase at middle, 15.8; least depth of rostrum behind incisors, 12.4; mandible, 38.8; maxillary toothrow (alveoli), 11.0; mandibular toothrow (alveoli), 10.0.

Specimen examined.—The type.

Remarks.—This rat conspicuously exceeds the largest hitherto known Philippine species in size. In this respect it can only be compared with *Epimys imperator* of the Solomon Islands; but it shares none of the peculiar cranial character of the latter.

EPIMYS GALA, new species.

Type-specimen.—Adult male (skin and skull), Cat. No. 144633, U.S.N.M. Collected on the Alag River, Mindoro, November 30, 1906, by Dr. Edgar A. Mearns. Original number 6334.

Diagnosis.—A dark local form of the *Epimys everetti* group; color of underparts not conspicuously contrasted with that of sides; feet blackish. Skull and teeth essentially as in *Epimys everetti*, but audital bullæ smaller and molars larger.

Color.—Back and sides a coarse grizzle of black and dull, light ochraceous-buff, the lighter color in excess everywhere except on rump; shoulders with a slight grayish tinge; sides, cheeks, and outer surface of legs somewhat lighter than back; underparts dull ochraceous-buff, not conspicuously contrasted with sides, the line of demarcation scarcely indicated; feet blackish brown, in noticeable contrast with legs; tail blackish through somewhat less than basal half, the distal portion yellowish.

Skull and teeth.—In all general features the skull agrees with that of *Epimys everetti*, but the audital bulla is noticeably smaller, its longitudinal diameter decidedly less than distance between bases of paroccipital processes. Teeth more robust than in the Luzon animal, the width of m^1 equal to fully three-quarters the least distance between tooth rows.

Measurements.—Type: Head and body, 209 mm.; tail, 241; hind foot (dry), 43.4; skull, condylobasal length, 48.0; zygomatic breadth, 24.8; interorbital constriction, 7.4; breadth of brain case over roots of zygomata, 19.0; depth of brain case at middle, 14.6; nasal, 20.4; diastema, 14.2; mandible, 31.2; maxillary toothrow (alveoli), 9.6; mandibular toothrow (alveoli), 9.4.

Specimens examined.—Two, the type and a half-grown individual, both from the Alag River.

TRYPHOMYS, new genus (Muridæ).

Type.—*Tryphomys adustus*, new species.

Characters.—External form murine, the tail about as long as body without head; hind foot with outer digits so reduced that neither extends beyond level of base of three median digits; fur of back coarse and harsh, the tips of the shorter hairs tending to curve forward, giving the pelage a peculiar scorched aspect; skull rather short and broad, with widely spreading zygomata and unusually large antorbital foramina; outer alveolar wall swollen into a noticeable protuberance at level of m^1 ; bony palate terminating in a broad median ridge bounded by lateral vacuities, the resulting form superficially like that of the same region in certain Microtine genera; teeth robust, their structure apparently not differing widely from those of *Epimys*.

TRYPHOMYS ADUSTUS, new species.

Plate 20.

Type-specimen.—Old female (skin and skull) Cat. No. 151511, U.S.N.M. Collected at Hights-in-the-Oaks, Benguet, Luzon, July 26, 1907, by Dr. Edgar A. Mearns. Original number 6457.

Diagnosis.—Size medium; form robust; tail about as long as body without head, coarsely and conspicuously ringed (8 rings to the centimeter at middle); thumb with a small, appressed nail; sole naked throughout, the five tubercles well developed, the fifth large; inner toe extending to base of three middle digits, the outer toe about to middle of inner; claws well developed, those on hind foot the largest; general color coarsely grizzled yellowish brown above, buffy gray below; tail uniform dark brown; mammæ, p. 2-2, v. 1-1, i 2-2=10.

Color.—Back and sides a coarse grizzle of wood-brown and black, the brown everywhere in excess, particularly on sides, where the black merely produces a slight effect of "lining;" median dorsal region abruptly more grizzled than sides, the recurved hairs showing an evident grayish cast in certain lights; bases of hairs slate-gray streaked by the lighter gray of the very slender grooved bristles; head and face essentially like back but with grayish cast somewhat more evident; underparts and cheeks buffy white dulled by the slate-gray under

color, the general effect a yellowish smoke-gray; line of demarcation rather evident; feet like underparts but with a decided tinge of brocoli-brown; tail uniform dark brown, the minute hairs with which it is sprinkled brownish or silvery according to light.

Skull.—The skull is robust and heavily built, its size and general outline when viewed from above much as in Thomas's figure of *Carpomys phæurus*,^a but zygomatic less widely spreading, outer wall of antorbital foramen so greatly developed that orifice is more conspicuous in dorsal view than when skull is seen from in front; margin of interorbital region conspicuously but narrowly beaded, the ridge continued backward to about middle of parietal, where it abruptly disappears. In lateral view the resemblance to *Carpomys phæurus* is less evident, as the depth at anterior base of zygoma is relatively much greater, so that the dorsal profile is evenly convex; the very wide outer wall of antorbital foramen is also conspicuous in this view; lower portion of anterior border of this plate vertical, upper portion strongly convex. Palate much narrower between anterior molars than posteriorly; incisive foramina long and narrow, their hinder border extending to level of anterior root of *m*¹; posterior border of palate at level of posterior margin of alveoli, its median region partly isolated by two lateral perforations, the resulting form superficially resembling that in certain *Microtinæ*; audital bullæ moderate, evenly inflated. Mandible deep and short, the coronoid process rising noticeably above condyle.

Teeth.—The teeth in the single known specimen are too worn to show the details of enamel folding. Apparently they do not differ essentially from those of members of the *Epimys rattus* group. Upper tooth rows strongly converging anteriorly.

Measurements.—Type: Head and body, 174 mm.; tail, 150; hind foot (dry), 33; skull, condylobasal length, 37.2; zygomatic breadth, 20.4; interorbital constriction, 5.2; mastoid breadth, 15.0; depth of brain case at middle, 13.0; nasal, 15.2; diastema, 10.4; mandible, 24.0; maxillary tooththrow (alveoli), 7.6; mandibular tooththrow (alveoli), 7.6.

BATOMYS DENTATUS, new species.

Plate 20.

Type-specimen.—Adult male (skin and skull) Cat. No. 151506, U.S.N.M. Collected at Hights-in-the-Oaks, Benguet, Luzon (altitude 7,000 feet), July 31, 1907, by Dr. Edgar A. Mearns. Original number 6484.

Diagnosis.—Size and general appearance as in *Batomys granti* Thomas, but under parts more buffy and terminal half of tail white; no bare area around eye; skull with much deeper brain case than in the related species; crowns of upper molars fully as wide as palate.

^aTrans. Zool. Soc. London, vol. 14, pl. 26, fig. 7.

External characters.—General external features agreeing with the description and figure of *Batomys granti*, except that the region immediately surrounding eye is normally furred, and the hairy covering of tail is so thin that the annulations are plainly visible (about 12 to the centimeter at middle).

Color.—Entire upper parts a uniform light-brown, slightly more yellow than the wood-brown of Ridgway, the face tinged with drab, the lumbar region and rump with russet, the entire area finely and inconspicuously varied by the blackish tips to the longer hairs and subterminal annulations on those of under fur; sides and flanks suffused with ochraceous buff, this color covering the entire under parts, except chin and throat, which are a pale cream-buff much darkened by the slate-gray under color; the general effect in this region a dull buffy drab; feet a dull buffy gray, the metapodials clouded with sepia; ears an indefinite dark brown; whiskers black; tail a uniform blackish brown through a little more than basal half, then abruptly white to tip.

Skull.—The skull of *Batomys dentatus* is about the same size and general form as that of *B. granti*, the dorsal and ventral views agreeing in all important characters with the figures published by Thomas.^a In lateral view, however, it differs conspicuously in the greater depth of brain case over front of parietals and the much more marked angle at which the posterior portion slopes toward the low occiput; depth at posterior margin of alveolar of m^3 contained about three times in condylobasal length instead of $3\frac{1}{2}$ times as in *B. granti*.

Teeth.—The disproportionately large teeth of *Batomys dentatus* is the most conspicuous feature of ventral aspect of skull. The width of crowns slightly exceeds that of palate at its narrowest point, while the length of tooth row measured along alveoli exceeds distance from alveolus of m^1 to front of incisive foramen by about 1.5 mm. (in *B. granti* it falls short of anterior extremity of foramen by about the same distance). The teeth of the type of *B. dentatus* are less worn than those of the type of *B. granti*, but allowance being made for this fact, the enamel pattern seems to be alike in the two animals. The actual differences are as follows: m^1 : second and third laminae completely separated, each with a well defined reentrant angle on anterior margin, partly isolating a small inner tubercle, this angle rather better defined than that of first lamina as figured by Thomas; m^2 : antero-internal tubercle distinct, not indicated by an enamel island as in the figure of *B. granti*; second and third laminae separate and of essentially the same form as in the preceding tooth; m^3 : elements as in m^2 and equally distinct, but inner tubercles of second and third laminae less well defined (the reentrant angles shallower), and median lobe narrower; m_1 with three transverse laminae, the second and third

^a Trans. Zool. Soc. London, vol. 14, pl. 36, fig. 8.

completely separated, deeply bilobate from behind, the first smaller, simple, joined to second at middle; terete postero-median lobe distinct, not forming an island as in the type of *B. granti*; m_2 essentially like m_1 , except for absence of anterior lamina; m_3 with two distinct laminae, the first like that of m_2 , the second elliptical in outline, with no indication of reentrant angle on posterior border.

Measurements.—Type: Head and body, 195 mm.; tail, 185; hind foot (dry), 36; skull, condylobasal length, 42.2; zygomatic breadth, 23.0; interorbital constriction, 6.0; mastoid breadth, 15.4; greatest depth of brain case, 12.4; nasal, 18.8; diastema, 12.2; mandible, 28.2; maxillary tooth row (alveoli), 9.6; mandibular tooth row (alveoli), 9.8; width of crown of m^1 , 2.8; least width of bony palate, 2.8.

Specimen examined.—The type.

APOMYS BARDUS, new species.

Type-specimen.—Adult male (skin and skull), Cat. No. 144582, U.S.N.M. Collected at summit of Mount Bliss, Mindanao (altitude 5,750 feet) May 28, 1906, by Dr. Edgar A. Mearns. Original number 6166.

Diagnosis.—Size and general appearance as in the forms inhabiting Mount Apo, but skull differing noticeably in the much narrower, less inflated brain case.

Color.—The color is so essentially like that of *Apomys insignis* Mearns^a as to require no special description.

Skull and teeth.—In general form the skull is much as in *Apomys insignis*, but the brain case differs from that of all three of the forms described from Mount Apo in its narrower more elongated form, the greatest breadth contained about $2\frac{1}{2}$ times in upper length of skull instead of about $2\frac{1}{2}$ times or less. Teeth with no special peculiarities.

Measurements.—Type: Head and body, 113 mm.; tail, 162; hind foot (dry), 33. Average and extremes of six adults: Head and body, 109 (98–118); tail, 156.3 (146–162); hind foot (dry), 31.4 (30–33). Skull of type (teeth moderately worn): Condylobasal length, 28.8; zygomatic breadth, 14.2; interorbital constriction, 4.8; breadth of brain case over roots of zygomatics, 13.2; depth of brain case at middle, 9.4; nasal, 11.8; diastema, 7.8; mandible, 16.8; maxillary tooth row (alveoli), 5.8; mandibular tooth row (alveoli), 5.2.

Specimens examined.—Nine, all from the summit of Mount Bliss. Other specimens from Grand Malindang (9,000 feet) are probably referable to the same form.

APOMYS MAJOR, new species.

Type-specimen.—Adult female (skin and skull), Cat. No. 151513, U.S.N.M. Collected at Hights-in-the-Oaks, Benguet, Luzon (altitude 7,000 feet), August 2, 1907, by Dr. Edgar A. Mearns. Original number, 6531.

Diagnosis.—Size noticeably greater than in the Mindanao species (hind foot 32.2, condylobasal length of fully adult skull about 35 mm.); underparts grayish instead of buffy.

Color.—Upper parts wood-brown, a little darker than that of Ridgway, clearer and less dark on shoulders, cheeks, and sides of neck, darker and with a rusty tinge posteriorly; face and crown to between ears grayish though not in evident contrast; underparts pale smoke gray with a buffy cast, wrists and ankles hair-brown; forefeet, dull whitish; hind feet whitish mixed with hair-brown; tail dusky throughout; lighter below than above.

Skull and teeth.—Except for their noticeably greater size the skull and teeth do not differ appreciably from those of *Apomys insignis*.

Measurements.—Type: Head and body, 143 mm.; tail, 144; hind foot (dry), 32.2; skull (teeth moderately worn), condylobasal length, 34.8; zygomatic breadth, 17.2; interorbital constriction, 6.0; breadth of brain case over roots of zygomata, 14.8; depth of brain case at middle, 10.0; nasal, 15.0; diastema, 10.2; mandible, 21.4; maxillary tooth row (alveoli), 6.2; mandibular tooth row (alveoli), 6.0.

Specimens examined.—Four, all from the type-locality.

APOMYS MUSCULUS, new species.

Plate 19.

Type-specimen.—Adult female (skin and skull), Cat. No. 145770, U.S.N.M. Collected at Camp John Hay, Baguio, Benguet, Luzon (altitude 5,000 feet), May 6, 1907, by Dr. Edgar A. Mearns. Original number, 6409.

Diagnosis.—Size much less than in any of the other known species (hind foot about 20 mm., condylobasal length of skull about 22.5 mm.); color essentially as in the buff-bellied Mindanao forms.

Color.—Entire body and head ochraceous-buff, clear and rather light on sides; cheeks and under parts tinged with ochraceous-rufous and slightly clouded with black above; face slightly grayish; feet buffy gray, not conspicuously different from underparts; tail obscurely bicolor, brownish above, whitish below.

Skull and teeth.—Aside from its much smaller size the skull differs from that of other known members of the genus in its relatively somewhat larger and more globular brain case, more abruptly constricted interorbital region, and more nearly vertical anterior border of plate forming outer wall of infraorbital canal. Other features of skull strictly as in the larger species. The teeth show no peculiarities apart from their small size.

Measurements.—External measurements of type: Head and body, 86 mm.; tail (imperfect), 89; hind foot (dry), 19.6. Young adult male from the type locality: Hind foot (dry), 21. Cranial measurements of type (teeth moderately worn): Condylobasal length, 22.6; zygomatic breadth, 13.0; interorbital constriction, 4.0; breadth of

brain case over roots of zygomata, 12.0; depth of brain case at middle, 8.0; nasal, 9.0; diastema, 6.0; mandible, 13.8; maxillary tooth row (alveoli), 4.6; mandibular tooth row (alveoli), 4.2.

Specimens examined.—Two, both from Baguio.

TARSIVS FRATERCULUS, new species.

Type-specimen.—Adult female (skin and skeleton) No. 94, P. B. S., Sevilla, Bohol, April 9, 1906. A. Celestino and M. Canton, collectors.

Diagnosis.—Like *Tarsius philippensis* of Mindanao but smaller. Hind foot about 60 mm.; greatest length of skull about 38 mm.

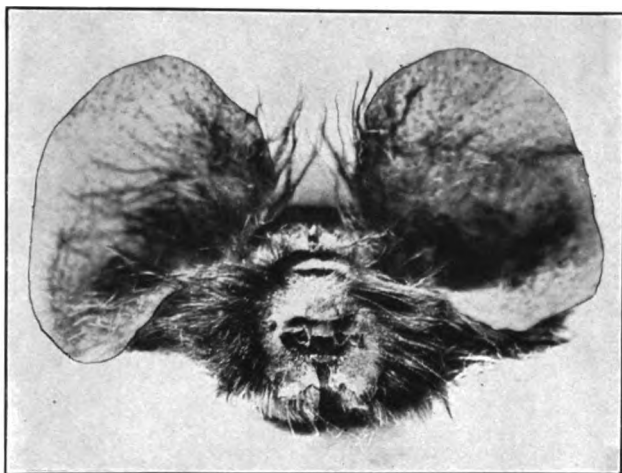
Color.—Upper parts, sides of body, and outer surface of limbs dull ochraceous buff, more yellowish posteriorly and on legs, more grayish anteriorly and on arms; the posterior half of back clouded with a slight irregular wash of dark brown; under color light slaty gray (about gray No. 6 of Ridgway); chin and throat essentially naked, the short, scant hairs dull buffy gray; chest and belly slaty gray, washed with dull buff anteriorly and with pale cream-buff posteriorly; pubic region and inner surface of thighs clear buff; tail blackish, the hairs on terminal third mixed brownish and buffy; ears light brown at base, blackening distally.

Skull and teeth.—Except for their uniformly smaller size the skull and teeth resemble those of *T. philippensis*.

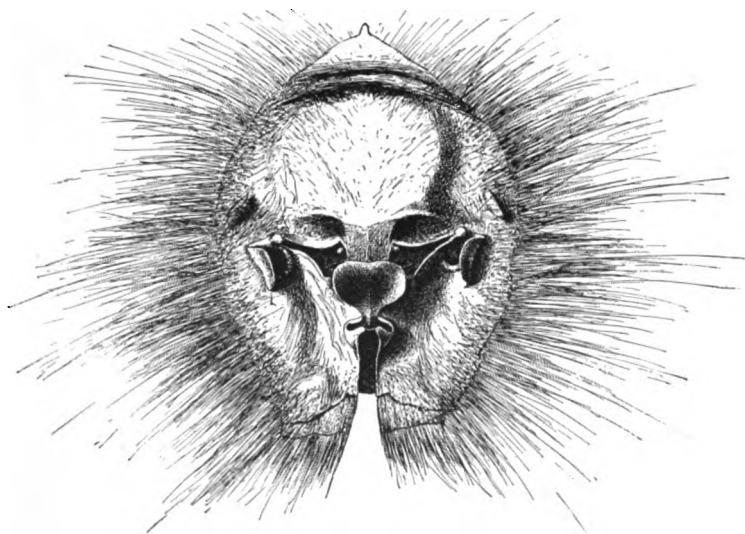
Measurements.—Type (from skeleton): Head and body, 120 mm.; tail vertebræ, 210; hind foot, $60 \pm$. A second specimen (also female) from the type-locality: Hind foot (dry), 61. Cranial measurements of the two specimens (those of type first): Greatest length, 38.0, 38.0 (39.8);^a condylobasal length, 30.5, 30.8 (32.4); zygomatic breadth, 26.5, 27.2 (27.4); greatest orbital breadth, 31.2, 31.6 (33.4); least interorbital breadth, 1.5, 1.8 (1.8); breadth of brain case over roots of zygomata, 21.9, 22.3 (23.0); depth of brain case at middle, 16.0, 15.3 (17.6); breadth of rostrum over roots of canines, 6.6, 6.2 (6.4); mandible, 25.0, 24.9 (26.4); maxillary tooth row (entire), 16.6, 16.5 (17.0); mandibular tooth row (entire), 13.8, 13.9 (15.4).

Specimens.—Two from Bohol, both females, with teeth beginning to wear.

^a Measurements in parentheses are those of a female *Tarsius philippensis* of the same age, from Zamboanga, Mindanao (Cat. No. 144643, U.S.N.M.).

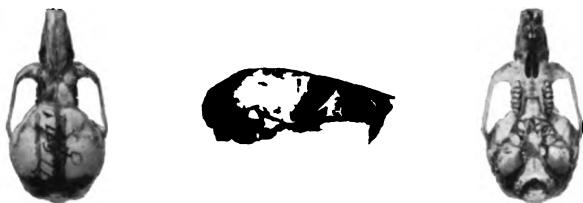


CHILOPHYLLA HIRSUTA X 3.

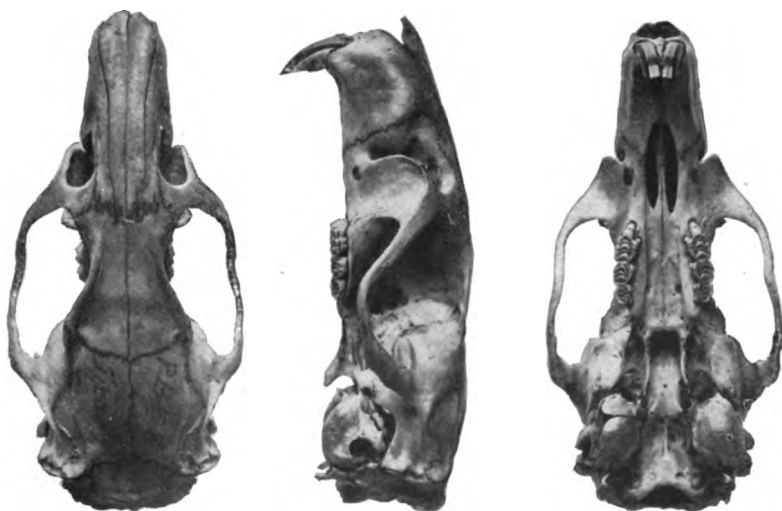


CHILOPHYLLA HIRSUTA. NOSELEAF GREATLY ENLARGED.

FOR EXPLANATION OF PLATE SEE PAGE 395.



APOMYS MUSCULUS, TYPE. (NATURAL SIZE.)



EPIMYS TYRANNUS, TYPE. (NATURAL SIZE.)

FOR EXPLANATION OF PLATE SEE PAGES 397 AND 403.



TRYPHOMYS ADUSTUS, TYPE. (NATURAL SIZE.)



BATOMYS DENTATUS, TYPE. (NATURAL SIZE.)

FOR EXPLANATION OF PLATE SEE PAGES 399 AND 400.

NOTES ON THE MARINE COPEPODA AND CLADOCERA OF WOODS HOLE AND ADJACENT REGIONS, INCLUDING A SYNOPSIS OF THE GENERA OF THE HARPACTICOIDA.

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There are but few reports on the marine Entomostraca of the eastern shores of North America. Thompson and Scott in 1897 published studies on some collections made in the Gulf of St. Lawrence, and in 1900 Prof. W. M. Wheeler, now of Harvard University, made the first contribution of importance since the time of Dana. In 1906 and 1907 Dr. L. W. Williams of the Harvard Medical School reported studies on species from the Narragansett Bay region of Rhode Island. In this report Doctor Williams lists twenty-six free swimming Copepods, while Wheeler records thirty from the Woods Hole region, and Thompson and Scott mention eight from the region about the mouth of the St. Lawrence.

The notes herein recorded are taken from material brought together by the U. S. Bureau of Fisheries schooner *Grampus* and from other collections mostly made in the littoral zones of the Woods Hole region. Little remains to be added in a paper of this sort to Wheeler's report on the pelagic forms.

It is perhaps unnecessary to add that these notes are at best very incomplete. They represent the partial results of a five weeks' use of a table at the U. S. Bureau of Fisheries laboratory at Woods Hole, Massachusetts.

A dichotomic synopsis of the genera of the Harpacticoida is inserted following the text, in the hope that it will prove useful in the study of these very minute and difficult forms. Very little has been done along this line. Much of the data used is taken from Dr. G. O. Sars' *Crustacea of Norway*, vol. 5, Harpacticoida. The writer herewith expresses his high esteem for Doctor Sars' splendid work, without which the compilation of a synoptic table anywhere near up to date would have been an impracticable task.

I also take much pleasure in expressing my sincere appreciation of the courtesies extended me by Dr. F. B. Sumner, director of the Woods Hole Station; and to Dr. F. A. Lucas, curator in chief, and Mr. E. L. Morris, curator, department of natural science, and to Miss

Susan A. Hutchinson, curator of books, all of the museum staff of the Brooklyn Institute of Arts and Sciences.

The following summary is an attempt to tabulate the list of known species of Copepoda and Cladocera for our northeastern shores.

SUMMARY OF SPECIES.

Order COPEPODA.

Tribe GYMNOPLA.

1. Family CALANIDÆ.

1. Genus *Calanus*.

1. *C. finmarchicus* (Gunnerus), Narragansett Bay, Rhode Island (Williams); Vineyard Sound (Wheeler); station 345, *Grampus*; off Delaware Bay; *Grampus* stations 1, 325, 626, 528, 327, and Nantucket Sound.

2. *C. minor* Claus, Gulf Stream, south of Marthas Vineyard, July (Wheeler).

2. Genus *Eucalanus*.

3. *E. attenuatus* Dana, Gulf Stream south of Marthas Vineyard, July (Wheeler).

4. *E. monachus* Giesbrecht, Gulf Stream south of Marthas Vineyard, July (Wheeler).

3. Genus *Mecynocera*.

5. *M. clausii* I. C. Thompson, Gulf Stream south of Marthas Vineyard, July (Wheeler).

4. Genus *Paracalanus*.

6. *P. parvus* Claus, Gulf Stream south of Marthas Vineyard, July (Wheeler).

5. Genus *Calocalanus*.

7. *C. pavo* Dana, Gulf Stream, as above (Wheeler).

8. *C. plumulosus* Claus, Gulf Stream, as above (Wheeler).

6. Genus *Clausocalanus*.

9. *C. arcuicornis* Dana, Gulf Stream, as above (Wheeler).

7. Genus *Pseudocalanus*.

10. *P. elongatus* (Boeck), Narragansett Bay, Rhode Island, February (Williams).

8. Genus *Euchaeta*.

11. *E. spinosa* Giesbrecht, Sagamore Bay, Cape Cod, June.

2. Family CENTROPAGIDÆ.

9. Genus *Centropages*.

12. *C. typicus* Kröyer, Woods Hole, June to November; Nantucket and Vineyard sounds, Plymouth Harbor, Gulf Stream south of Marthas Vineyard (Wheeler).

13. *C. hamatus* (Lilljeborg), Woods Hole (Wheeler); Narragansett Bay, Rhode Island, January and February (Williams).

14. *C. bradyi* Wheeler, Gulf Stream, south of Marthas Vineyard (Wheeler).

10. Genus *Temora*.

15. *T. longicornis* (Müller), Woods Hole, cooler months (Wheeler); Narragansett Bay, Rhode Island, all through the year (Williams). Common.

11. Genus *Eurytemora*.

16. *E. herdmani* Thompson and Scott, Narragansett Bay, Rhode Island (Williams); Woods Hole, August.

17. *E. hirundooides* (Nordquist), Woods Hole, August; Cuttyhunk, Massachusetts, July; Narragansett Bay (Williams).

2. Family CENTROPAGIDÆ—Continued.

- 18. *E. americana* Williams, Narragansett Bay, Rhode Island.
- 12. Genus *Metridia*.
- 19. *M. lucens* Boeck, Woods Hole and Plymouth Harbor.
- 13. Genus *Pseudodiaptomus*.
- 20. *P. coronatus* Williams, Woods Hole, July and August; Sheepshead Bay, September; Narragansett Bay (Williams).

3. Family CANDACIIDÆ.

- 14. Genus *Candacia*.
- 21. *C. armata* Boeck, Gulf Stream south of Marthas Vineyard (Wheeler).

4. Family PONTELLIDÆ.

- 15. Genus *Labidocera*.
- 22. *L. æstiva* Wheeler, Woods Hole at fisheries wharf (Wheeler).
- 16. Genus *Pontella*.
- 23. *P. meadii* Wheeler, Woods Hole, July (Wheeler).
- 17. Genus *Pontellopsis*.
- 24. *P. regalis* (Dana) Gulf Stream 70 miles south of Marthas Vineyard, July (Wheeler).
- 18. Genus *Anomalocera*.
- 25. *A. patersoni* Templeton, Gulf Stream 70 miles south of Marthas Vineyard (Wheeler); Woods Hole.
- 19. Genus *Acartia*.
- 26. *A. tonsa* Dana, Plymouth Harbor, Woods Hole, Gulf Stream south of Marthas Vineyard (Wheeler); Narragansett Bay (Williams); Jamaica Bay, New York.
- 27. *A. clausii* Giesbrecht, Narragansett Bay, all through the year (Williams).
- 20. Genus *Tortanus*.
- 28. *T. discaudatus* (Thompson and Scott) Gulf of St. Lawrence (Thompson and Scott); Vineyard Sound; Woods Hole.
- 29. *T. setacaudatus* Williams, Narragansett Bay, winter (Williams).

Tribe PODOPLEA.

5. Family CYCLOPIDÆ.

- 21. Genus *Oithona*.
- 30. *O. plumifera* Baird, Gulf Stream south of Marthas Vineyard, July (Wheeler).
- 31. *O. similis* Claus, Woods Hole at Fisheries wharf (Wheeler); Wickford, Rhode Island, summer (Williams).

6. Family HARPACTICIDÆ.

- 22. Genus *Microsetella*.
- 32. *M. norvegica* Boeck, Narragansett Bay, March (Williams).
- 23. Genus *Setella*.
- 33. *S. gracilis* Dana, Gulf Stream south of Marthas Vineyard, July (Wheeler).
- 24. Genus *Bradya*.
- 34. *B. limicola*, coast of Gulf of Mexico (Herrick).
- 25. Genus *Chytemnestra*.
- 35. *C. rostrata* Brady, Gulf Stream south of Marthas Vineyard, July (Wheeler).
- 26. Genus *Miracia*.
- 36. *M. efferenta* Dana, Gulf Stream south of Marthas Vineyard, July (Wheeler).
- 27. Genus *Harpacticus*.
- 37. *H. chelifer* (Müller), Charlestown Pond, July (Williams); Sheepshead Bay, New York, September; Hunters Island, New York, September; Little Harbor, Woods Hole, July.
- 38. *H. uniremis* Krøyer, Narragansett Bay, February and April; Charlestown Pond, July (Williams).

7. Family ECTINOSOMIDÆ.
 28. Genus *Ectinosoma*.
 39. *E. curticorne* Boeck, Wickford, and Charlestown Pond, Rhode Island, summer (Williams); brackish pond, Woods Hole, July.
 40. *E. normani* Thompson and Scott, Charlestown Pond, summer (Williams).
8. Family PELTIDIIDÆ.
 29. Genus *Alteutha*.
 41. *A. depressa* Baird, Sheepshead Bay, New York, September; Woods Hole, August.
9. Family TEGASTIDÆ.
 30. Genus *Parategastes*.
 42. *P. sphaericus* (Claus), Wickford and Charlestown Pond, Rhode Island (Williams).
10. Family IDYIIDÆ.
 31. Genus *Idya*.
 43. *I. furcata* (Baird), Narragansett Bay, spring, common (Williams); Little Harbor, Woods Hole, July.
11. Family THALESTRIDÆ.
 32. Genus *Thalestris*.
 44. *T. gibba* (Krøyer), Woods Hole, December, "Surface net" (Vinal N. Edwards).
 33. Genus *Halithalestris*.
 45. *H. croni* (Krøyer), *Grampus* station 528, July; also station 627, July; Cape Cod.
 34. Genus *Dactylopusia*.
 46. *D. thisboides* (Claus), Little Harbor, Woods Hole, July.
 47. *D. vulgaris* Sars, Wickford and Charlestown Pond, Rhode Island, July (Williams); Woods Hole, common.
12. Family DIOSACCIDÆ.
 35. Genus *Diosaccus*.
 48. *D. tenuicornis* (Claus), Charlestown Pond, Rhode Island, July (Williams); Eel Pond, Woods Hole, August.
13. Family LAOPHONTIDÆ.
 36. Genus *Laophonte*.
 49. *L. longicaudata* Boeck, Woods Hole, July.
14. Family LICHOMOLGIDÆ.
 37. Genus *Lichomolgus*.
 50. *L. fucicolus* Brady, Wickford and Charlestown Pond, Rhode Island (Williams); Buzzard's Bay, July.
 51. *L. adherens* Williams, Wickford, Rhode Island, under stones, between tides (Williams).
 52. *L. major* Williams, Wickford, Rhode Island, mantle cavities of *Mya*, *Venus*, and *Macra* (Williams).
15. Family TACHIDIIDÆ.
 38. Genus *Tachidius*.
 53. *T. brevicornis* (Müller), Charlestown Pond, Rhode Island (Williams); Jamaica Bay, New York, June.
 54. *T. littoralis* Poppe, upper Narragansett Bay, May and April (Williams).
16. Family ONCÆIDÆ.
 39. Genus *Oncæa*.
 55. *O. venusta* Philippi, Gulf Stream 60 miles south of Marthas Vineyard, July (Wheeler).

17. Family CORYCÆIDÆ.

40. Genus *Corycæus*.

56. *C. elongatus* Claus, Gulf Stream 70 miles south of Marthas Vineyard, July (Wheeler).

57. *C. carinatus* Giesbrecht, as above (Wheeler).

41. Genus *Sapphirina*.

58. *S. gemma* Dana, Gulf Stream south of Marthas Vineyard, July (Wheeler).

18. Family ILYOPSYLLIDÆ.

42. Genus *Ilyopsyllus*.

59. *I. sarsi* Sharpe, harbors and brackish ponds, Woods Hole, Massachusetts.

60. *I. natans* Williams, Wickford and Charlestown Pond, Rhode Island, summer (Williams).

Order CLADOCERA.

Division GYMNOMERA.

Tribe ONYCHOPODA.

1. Family POLYPHEMIDÆ.

1. Genus *Podon*.

1. *P. leuckarti* (G. O. Sars), surface tows off Bureau of Fisheries wharf, Woods Hole, Massachusetts, July to November.

2. Genus *Evadne*.

2. *E. nordmanni* Lovén, Narragansett Bay, Rhode Island, summer (Williams); surface tows off Bureau of Fisheries wharf, Woods Hole, Massachusetts, August to November.

ANNOTATED LIST.

Order COPEPODA.

Tribe GYMNOPLA.

Family CALANIDÆ.

Genus CALANUS Leach, 1819.

CALANUS FINMARCHICUS (Gunnerus).

Calanus finmarchicus G. O. Sars, Crustacea of Norway, Calanoida, vol. 4, 1903, p. 9, pls. 1, 2, 3, 22 figs.

Length.—Female, 2.7 to 5.4 mm; male, 2.35 to 3.6 mm.

Said to be our commonest North Atlantic and Arctic Copepod. Sars speaks of it as being "eagerly devoured by our common food fishes, as the herring and mackerel." Prof. Robert Collett states that it forms the almost exclusive food of one of the great whales, *Balænoptera borealis*.

Their great abundance in northern waters would seem to bear out the general rule that "the nearer the cold zone, the smaller the number of species, but the larger the number of individuals of the species."

Common in tows from Narragansett Bay, Rhode Island (Williams); Vineyard Sound off Gayhead (Wheeler); Bureau of Fisheries wharf, Woods Hole, Massachusetts. Also the following stations of the U. S. Fisheries schooner *Grampus*:

Station 325, May 29, 1894, lat. $45^{\circ} 47' 30''$ N., long. $50^{\circ} 57' 45''$ W.

Station 327, May 29, 1894, lat. $45^{\circ} 55' 15''$ N., long. $59^{\circ} 35' 00''$ W.

Station 626, July 29, 1894, lat. $49^{\circ} 43' 30''$ N., long. $64^{\circ} 24' 00''$ W.

Station 528, June 28, 1895, lat. $42^{\circ} 35' 00''$ N., long. $70^{\circ} 19' 00''$ W.

These stations were occupied while the *Grampus* was engaged in mackerel work, and are tow-net stations.

Genus EUCHÆTA Philippi, 1852.

EUCHÆTA SPINOSA Giesbrecht.

Euchæta spinosa GIESBRECHT, Fauna und Flora des Golfes von Neapel, etc., 1892, p. 246, 8 figs.

Length.—Females, 6 mm.; males, unknown.

Characters.—First antenna reaches slightly beyond the abdomen. Two terminal setæ of the furca much longer than the others (fig. 1b). Outer branch of the second leg with a characteristically invaginated segment (fig. 1a).

Occurrence.—Surface collection off Nausett Beach, Cape Cod, June. Also *Grampus* station 627, lat. $42^{\circ} 7'$ N., long. $70^{\circ} 8'$ W., just off the northern part of Cape Cod, July, 11 p. m.

Distribution.—Mediterranean Sea, North Atlantic, Pacific, and Indian oceans.

Family CENTROPAGIDÆ.

Genus EURYTEMORA Giesbrecht, 1881.

EURYTEMORA HERDMANI Thompson and Scott.

Eurytemora herdmanni THOMPSON and SCOTT, Proc. Liverpool Biol. Soc., vol. 12, 1897, p. 78, figs. 1, 8, 10.—GIESBRECHT and SCHMEIL, Das Tierreich, Dec. 1898, p. 103.—VAN BREEMEN, Nordisches Plankton, VIII, Copepoden, 1908, p. 100, 3 figs.

Length.—1.5 to 1.8 mm.

Characters.—Last thoracic segment of female produced into large wing-like expansions. Genital segment of female with conspicuous lateral swellings, which are directed angularly backwards.



FIG. 1.—EUCHÆTA SPINOSA. a, SECOND FOOT $\times 150$; b, FURCA, VENTRAL $\times 75$ (AFTER GIESBRECHT).

First antenna about as long as the cephalothorax. Fifth feet of female apparently four-segmented, but consisting really of a two-segmented basal part and a two-segmented exopodite. First segment of exopodite long, narrow, with two strong outer marginal setæ, and with a long pointed projection of its inner edge, which is heavily armed with very short stout spines (fig. 2c). Terminal segment twice as long as broad. Fifth legs of male very similar to those of *E. velox*.

Remarks.—This species was first described from specimens collected in association with *E. affinis*, in the St. Lawrence River, between Quebec and Rimouski. The only other report of its occurrence was made by Dr. L. W. Williams in 1906, when he mentioned its presence in tows made in Narragansett Bay, Rhode Island, near Wickford. Found very sparingly by the writer in a surface tow

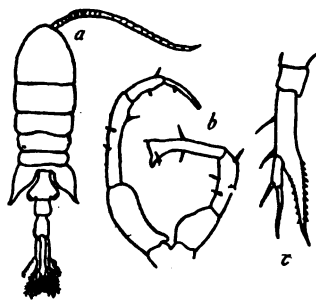


FIG. 2.—EURYTEMORA HERDMANI. *a*, DORSAL VIEW OF FEMALE $\times 35$; *b*, FIFTH FOOT OF FEMALE $\times 100$; *c*, FIFTH FOOT OF FEMALE $\times 150$.

made from the Bureau of Fisheries wharf. Woods Hole, Massachusetts, in August.

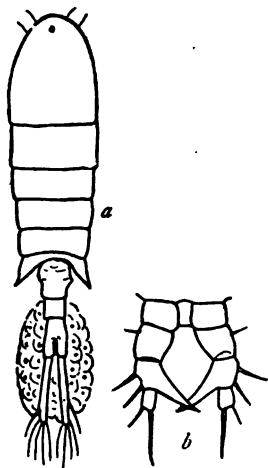


FIG. 3.—EURYTEMORA HIRUNDOIDES. *a*, DORSAL VIEW OF FEMALE; *b*, FIFTH FOOT OF FEMALE.

EURYTEMORA HIRUNDOIDES (Nordquist).

Temorella affinis, var. *hirundoides* NORDQUIST, Die Calaniden Finlands, vol. 4, 1888, p. 48, figs. 5–11; vol. 5, fig. 5.

Eurytemora affinis, var. *hirundoides* GIESBRECHT, Zool. Jahrb. Syst., vol. 9, 1896, p. 104.

Eurytemora hirundoides G. O. SARS, Crustacea of Norway, vol. 4, Calanoida, 1903, p. 102.—VAN BREEMEN, Nordisches Plankton, VIII, Copepoden, 1908, p. 101, figs. *a*–*d*.

Length.—0.3–1.15 mm.

Characters.—Somewhat like *E. affinis*. Lateral part of last thoracic segment of female pointed. Genital segment of female swollen. First antenna about as long as the cephalothorax.

Occurrence.—Rather sparsely found in brackish pools, Woods Hole, July; also in washings from sea-urchins, Cuttyhunk, July.

Distribution.—Norwegian coast (Sars), Narragansett Bay and Charlestown Pond (Williams).

Genus METRIDIA Boeck, 1864.

METRIDIA LUCENS Boeck.

Paracalanus hibernicus BRADY and ROBERTSON, Ann. Mag. Nat. Hist. (4), vol. 12, 1873, p. 126.

Metridia hibernica GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, 1892, p. 340, figs. 2, 12, 16, 22, 28, 36, 39.—WHEELER, Bull. U. S. Fish. Comm., vol. 19, 1900, p. 176, figs. a-f.

Metridia lucens BOECK, Forh. Vid. Selsk. Christiania, 1864, p. 14.—GIESBRECHT and SCHMEIL, Das Tierreich, Dec. 1898, p. 106.—G. O. SARS, Crustacea of Norway, vol. 4, Calanoida, 1903, p. 113.

Length.—Female, 2.45 to 2.85 mm.; male, 2 mm.

Occurrence.—Found in tow at Plymouth Harbor, August, and at Woods Hole, December (Wheeler).

Distribution.—Mediterranean Sea, North Atlantic and Pacific oceans; Gulf of Suez.

Genus PSEUDODIAPTOMUS Herrick, 1884.

PSEUDODIAPTOMUS CORONATUS Williams.

Pseudodiaptomus coronatus WILLIAMS, Amer. Nat., vol. 40, 1906, p. 641, figs. 1-7.

Length.—Female, about 1.5 mm.; male, 1.2 mm.

Characters.—Abdomen of male, five-segmented; of female, four-segmented. First segment of abdomen of female much swollen and with many spines and bristles arranged in irregular patches, and with a pair of small spatulate flaps extending over the genital orifice. Left side of second segment of abdomen has a small depression filled with coarse bristles. Fifth legs of female (fig. 4a) four-segmented, with heavy terminal claws; of male, as in fig. 4b.

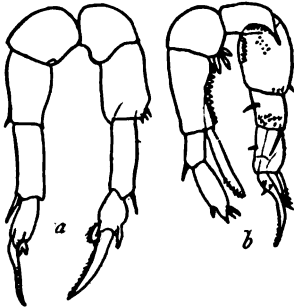


FIG. 4.—PSEUDODIAPTOMUS CORONATUS. a, FIFTH FOOT OF FEMALE \times 175; b, FIFTH FOOT OF MALE \times 150 (AFTER WILLIAMS).

The females are commonly with two egg-sacs, the right one usually the smaller of the two, and containing an average of but two eggs. Occasionally the egg sacs are about equal in size, and one female was found in Eel Pond, Woods Hole, with but one large oval egg sac.

Remarks.—Many of these interesting Calanoids were noted in copula. The male clasps the female in a manner quite different from that commonly observed among the Harpacticoida, in that they seem always to unite with their anterior extremities pointed in exactly opposite directions, with the abdominal extremity of one or the other pointed to one side at an angle.

Occurrence.—Very common in birge and surface net tows among algæ, at Hadley Harbor, Great Harbor near Ram Island, and Eel Pond, Woods Hole, Massachusetts. Also Sheepshead Bay, New York, September.

Distribution.—Previously reported only from Narragansett Bay and Charlestown Pond, Rhode Island, summer (Williams).

Family CANDACIIDÆ.

Genus CANDACIA Dana, 1846.

CANDACIA ARMATA Boeck.

Candacia pectinata BRADY, Copepoda of the British Islands, vol. 1, 1878, p. 49.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, 1892, p. 242, 15 figures.—WHEELER, Bull. U. S. Fish Comm., vol. 19, 1900, p. 177, figs. a-e. *Candacia armata* BOECK, Forh. Vid. Selsk. Christiania, 1872, p. 39.—G. O. SARS, Crustacea of Norway, vol. 4, Calanoida 1903, p. 135, figs. 1-10.

Length.—Female, 1.95 to 2.7 mm.; male, 1.7 to 2.7 mm.

Characters.—Last thoracic segment of female with large posteriorly directed points. First antenna of female twenty-three-segmented, and not overreaching the genital segment.

Occurrence.—Gulf Stream about 70 miles south of Marthas Vineyard, July (Wheeler).

Distribution.—Mediterranean Sea and Atlantic Ocean (between 36° and 60° N. lat.) (Giesbrecht); Indian Ocean (Scott).

Family PONTELLIDÆ.

Genus PONTELLOPSIS Brady, 1883.

PONTELLOPSIS REGALIS (Dana).

Pontella regalis DANA, Proc. Amer. Acad. Arts and Sci., 1849, vol. 2, p. 31. *Monops regalis* GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, 1892, p. 486, 15 figures.—WHEELER, Bull. U. S. Fish Comm., vol. 19, 1900, p. 182, figs. a-c. *Pontellopsis regalis* GIESBRECHT and SCHMEL, Das Tierreich, Dec. 1898, p. 147.

Length.—Female, 4.0 to 4.4 mm.; male, 3.4 mm.

Color.—Dark blue-green.

Characters.—Last thoracic segment pointed on either side, but in male prolonged into a powerful slightly curved hook. Abdomen of female of two segments. Furca short.

Occurrence.—Gulf Stream, 70 miles south of Marthas Vineyard, July (Wheeler).

Distribution.—Mediterranean Sea; Atlantic, Pacific, and Indian oceans (between 13° N. and 26° S. lat.).

Genus ACARTIA Dana, 1846.

ACARTIA TONSA Dana.

Acartia tonsa DANA, Proc. Amer. Acad. Arts and Sci., 1849, vol. 2, p. 26.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, 1892, p. 508, 5 figures.—GIESBRECHT and SCHMEL, Das Tierreich, Dec. 1898, p. 154.—WHEELER, Bull. U. S. Fish Comm., vol. 19, 1900, p. 183, figs. a-d.

Length.—Female, 1.3 to 1.5 mm.; male, 1.05 mm.

Characters.—Rostral filaments present. Last thoracic segment rounded on sides. Abdomen without spines. Anal segment hairy on sides, but in male with fine points on the second segment. Middle segment of female fifth foot about as long as broad. Terminal claw more than twice as long as the terminal segment, straight, and alike for each foot.

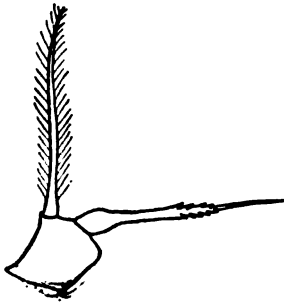


FIG. 5.—ACARTIA TONSA. FIFTH FOOT OF FEMALE X 500.

Wheeler, 1900, page 183, shows a figure of the fifth foot of the female which evidently is very exceptional; probably that of a mutilated specimen, or of a regenerated leg. All studied by the writer were as in fig. 5.

Occurrence.—One of the commonest copepods taken from the wharf of the Fish Commission at Woods Hole, summer (Wheeler).

Also Plymouth Harbor, and Gulf Stream 70 miles south of Marthas Vineyard (Wheeler). Also occurring abundantly in nearly all the tows examined by the writer from the Woods Hole region, even in the Eel Pond and the brackish water ponds of the vicinity. In fact, nearly all the pelagic copepods of these ponds were this species.

Distribution.—Port Jackson, New South Wales (Dana); west coast of South America, between Valparaiso and Callao (Giesbrecht).

Genus TORTANUS Giesbrecht.

TORTANUS DISCAUDATUS (Thompson and Scott).

Corymura discaudata THOMPSON and SCOTT, Proc. Liverpool Biol. Soc., vol. 12, 1897, p. 80, pl. 6, figs. 1-11; pl. 7, figs. 1, 2.

Corymura bumpusii WHEELER, Bull. U. S. Fish Comm., vol. 19, 1900, p. 185, figs. a-f.

Tortanus discaudatus GIESBRECHT and SCHMEL, Das Tierreich, Dec., 1898, p. 158.—VAN BREEMEN, Nordisches Plankton, VIII, Copepoden, p. 162, figs. a-c.

Length.—Female, 2.25 mm.; male 1.8 to 2 mm. Very similar to *T. gracilis* (Brady) but with the right furcal branch and its spine-like outer bristle much more thickened.

Endopodite of first leg three-segmented, which is very unusual for *Tortanus*.

Occurrence.—Tows off Fish Commission wharf and Vineyard Sound, July (Wheeler); off Fish Commission wharf, May (Vinal N. Edwards). Specimens collected by the writer from the same locality were blood-red in color and were unusually quick in their movements, moving by quick jerks. Wheeler says "both sexes rather opaque and without pigment, except along mid-ventral line, where there are segmental accumulations of black coloring matter in the male." (Wheeler, 1900, p. 185.)

Distribution.—Gulf of St. Lawrence; Puget Sound; Woods Hole.

Tribe **PODOPLEA**.

Family **HARPACTICIDÆ**.

Genus **HARPACTICUS** Milne Edwards, 1838.

HARPACTICUS CHELIFER (O. F. Müller).

Cyclops chelifer O. F. MÜLLER, Zool. Dan. Prodr., 1776, p. 2413; Entomostraca, 1785, p. 114, pl. 19, figs. 1-3.

Harpacticus chelifer CLAUS, Die Freilebenden Copepoden, 1863, p. 135, pl. 19, figs. 12-19.—BRADY, Copepoda of the British Islands, vol. 2, 1880, p. 146, pl. 64, figs. 19, 20; pl. 65, figs. 1-15.—G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 49, 18 figs.

Length.—Female, 9 mm.; male, 1 mm.

Characters.—Body unusually compressed, posterior maxillipeds very large. Fifth legs as in fig. 6.

Occurrence.—Collected in birge net at Little Harbor, Woods Hole, July; Hunters Island, New York City, October; Sheepshead Bay, New York, September.

Distribution.—British Isles (Brady); coast of France (Canu); Franz Josef Land (Scott); Ceylon (A. Scott); Heligoland (Claus).

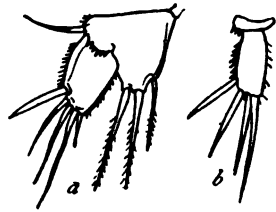


FIG. 6.—**HARPACTICUS CHELIFER**.
a, FIFTH FOOT OF FEMALE; b,
FIFTH FOOT OF MALE.

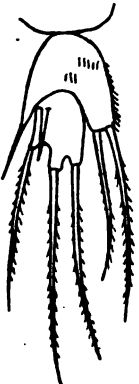


FIG. 7.—**ECTINOSOMA CURTICORNE**. FIFTH FOOT OF FEMALE.

Family **ECTINOSOMIDÆ**.

Genus **ECTINOSOMA** Boeck, 1864.

ECTINOSOMA CURTICORNE Boeck.

Ectinosoma curticorne BOECK, Forh. Vid. Selsk. (Christiana, 1872, p. 45.—G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 36, pl. 20, fig. 1.

Length.—Female, 0.7 mm.

Color.—Dark brown or corneous.

Characters.—Anterior antenna very short, of six segments, the first of which shows a well defined pigment spot. Caudal rami about twice as long as broad and slightly divergent.

Occurrence.—Collected by a birge net among algæ, muddy bottom, in the brackish ponds about Woods Hole, Massachusetts, July.

Distribution.—Scottish coasts (Scott); Spitzbergen (Scott); Norwegian Fjords (Sars); Charlestown Pond, Rhode Island (Williams).

Family PELTIDIIDÆ.

Genus ALTEUTHA Baird, 1846.

ALTEUTHA DEPRESSA Baird.

Alteutha depressa BAIRD, British Entomostraca, 1850, p. 216, pl. 30, figs. 1, 2.—BRADY, Copepoda of the British Islands, vol. 2, 1880, p. 160, figs. 1-5.—G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 64, pl. 38, 12 figs.

Length.—Female, about 1.3 mm.

Characters.—Body yellowish in color, but with a strikingly dark purplish transverse band near the middle, occupying three segments. Body much depressed seen dorsally, oblong-oval in form, with the greatest width about the middle. Cephalic segment very large, exceeding in length the four succeeding segments combined. Anterior antenna short and stout, nine-segmented. Fifth legs robust, and armed at the tip with three coarse spines (fig. 8 b).

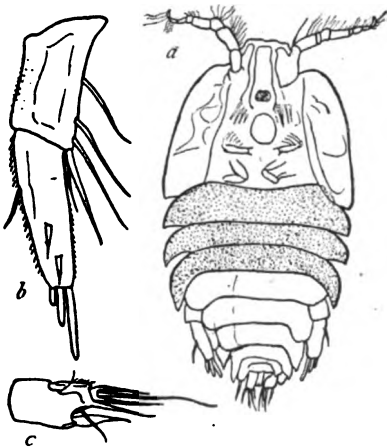


FIG. 8.—ALTEUTHA DEPRESSA. a, VENTRAL VIEW OF MALE; b, FIFTH FOOT OF FEMALE; c, CAUDAL RAMUS OF FEMALE.

Remarks.—When seen with a small lens the most striking character is the shape and color. It somewhat superficially resembles certain of the parasitic Copepods, as *Argulus*. While Sars (1903, p. 64) speaks of it as usually occurring in depths varying from 6 to 20 fathoms on a sandy or gravelly bottom, my best haul of these

curious little creatures was made with a surface net, but a few inches below the surface in open water just along the Bureau of Fisheries wharf at Woods Hole, Massachusetts.

Occurrence.—Collected with a birge net among algæ, in about 2 fathoms of water, over sandy bottom, Sheepshead Bay, New York, September. Also surface net just off Fisheries wharf, Woods Hole, Massachusetts. It has not, to my knowledge, been heretofore reported from American shores.

Distribution.—British seas (Brady); coast of France (Canu); west coast of Norway and Trondhjem Fjord (Sars).

Family IDYIIDÆ.

Genus IDYA Philippi, 1843.

IDYA FURCATA (Baird).

Cyclops furcatus BAIRD, Mag. Zool. and Bot., vol. 9, 1837, figs. 26-28.

Canthocamptus furcatus BAIRD, British Entomostraca, 1850, p. 210, figs. 1-6.

Tisbe furcatus CLAUS, Die Freilebenden Copepoden, 1863, p. 116, figs. 1-12.

Idya furcata BRADY, Copepoda of the British Islands, vol. 2, 1880, p. 172, figs.

1-11.—G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 88, 14 figs.

Length.—Female, average, 1 mm.; male, 0.65 mm. Maximum length of deep-water variety, 1.5 mm.

Characters.—Body of female whitish in color and more or less transversely banded with clear crimson; ovarian tubes commonly of a clear dark color.

Caudal rami scarcely as long as the anal segment. Fifth pair of legs of the female with the inner expansion of the proximal joint broadly rounded and armed with three setæ, the middle one rather slender, the other two very small; distal segment sublinear, with five slender setæ, of which three issue from the tip and two from the outer edge close to the end.

Remarks.—Perhaps the commonest and most widely distributed of all the Harpacticoida. While it is most commonly to be found with littoral forms, yet a larger pelagic form is to be met with at greater depths on decaying algæ. "A very active creature, swimming about with great speed, now and then affixing itself to fronds of the algæ or to the walls of the vessel in which it is being observed" (Sars).

Occurrence.—Collected with a birge net amongst floating algæ and eel grass at Little Harbor, Woods Hole, July. Water about 10 feet deep at high tide, sandy bottom. Also from Eel Pond, Woods Hole, August.

Distribution.—Arctic Ocean, widely distributed; British seas; Kattegat; coast of France (Canu); Mediterranean and Red seas (A. Scott); New Zealand (Brady); Pacific at Chatham Islands (Sars); Franz Josef Land (Scott); Narragansett Bay, Rhode Island (Williams).

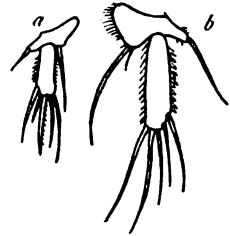


FIG. 9.—IDYA FURCATA. *a*, FIFTH FOOT OF MALE; *b*, FIFTH FOOT OF FEMALE.

Family THALESTRIDÆ.

Genus THALESTRIS Claus, 1863.

THALESTRIS GIBBA (Krøyer).

Harpacticus gibba KRØYER, Gaimard's Voyage en Scandinavie, 1845, pl. 43, figs. 2, *a-p*.

Thalestris gibba, G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 105, pl. 61, 12 figs.

Length.—Female, 1.5 mm.; male slightly smaller.

Characters.—Color of body, except dorsal face of the cephalic segment, dark bluish gray to almost black. Posterior edges of

all the segments minutely crenulated. Caudal rami unusually produced, about three times as long as broad.

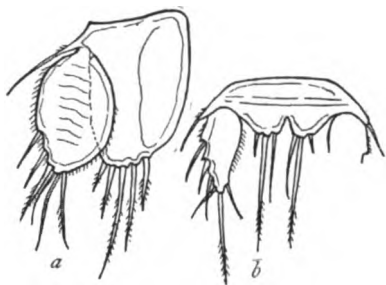


FIG. 10.—*Thalestris gibba*. *a*, FIFTH FOOT OF FEMALE (AFTER SARS); *b*, FIFTH FOOT OF MALE.

Occurrence.—Found in a surface tow made by Mr. Vinal N. Edwards of the U. S. Fish Commission at Woods Hole, December.

Distribution.—Norwegian coast (Sars); Franz Josef Land (Scott).

This species appears heretofore not to have been reported from American shores. Seemingly a boreal form, brought to the Woods Hole region by the Labrador current.

Genus *HALITHALESTRIS* Sars, 1903.

HALITHALESTRIS CRONI (Krøyer).

Harpacticus croni KRØYER, Gaimard's Voyage en Scandinavie, 1845, Zool., pl. 43, figs. 3, *a-n*.

Thalestris serrulata BRADY, Copepoda of the British Islands, vol. 2, 1880, p. 133, figs. 2-11 (male).

Halithalestris croni G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 118, pl. 72, 12 figs.

Length.—Female, 2.3 mm.; male, 1.7 mm.

Characters.—Cephalic segment hardly longer than the three following segments taken together. Rostrum short. Genital segment about as long as wide. Furca very long, about half as long as the abdomen and with widely divergent rami. First antennæ shorter than the cephalic segment. Fifth leg reaching nearly to the middle of the genital segment, its terminal segment (female) oval, and with six marginal bristles, of which two are rather long. The same segment of male more elongate (fig. 11*b*), and terminal seta the longer. Basal segment triangular, with five terminal setæ in female and three in male, the middle one in each case being the longer. Egg sacs very large, reaching about to middle of furcal rami.

Body of a light greenish hue, and commonly filled with clear oil bubbles of various sizes.

Remarks.—One of the largest known Harpacticoids, and also very unusual in its habits in that it leads a truly pelagic life. Williams (1906) speaks of collecting it by scraping piles at high tide at Rocky Point in Narragansett Bay. He calls his specimen *Thalestris serrulata* Brady, which is mentioned above as a synonym, but as *Halithalestris croni* seems to be truly pelagic, and such a habitat as

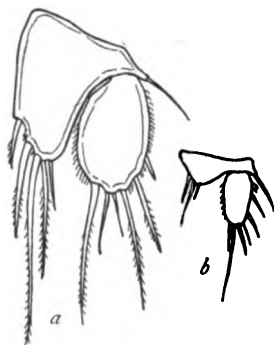


FIG. 11.—*HALITHALESTRIS CRONI*. *a*, FIFTH FOOT OF FEMALE (AFTER SARS); *b*, FIFTH FOOT OF MALE.

Williams mentions seems to rest on only one individual and also to be very unusual, it is presumed that his specimen is not the above species.

Occurrence.—Found in tows made by the U. S. Bureau of Fisheries schooner *Grampus* at station 528, July 18, 1894, 5 a. m., lat. $42^{\circ} 55' N.$, long. $68^{\circ} 49' W.$, and at station 627, July 29, 1894, 11 p. m., lat. $42^{\circ} 7' N.$, and long. $70^{\circ} 8' W.$

Distribution.—British seas (Brady)?; coast of Spitzbergen (Scott); off the coasts of Norway and Finmark (Sars).

Genus DACTYLOPUSIA Norman, 1903.

DACTYLOPUSIA THISBOIDES (Claus).

Dactylopusia thisboides CLAUS, Die Freilebenden Copepoden, 1863, p. 127, figs. 24–28.—G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 126, pls. 77, and 97, 11 figs.

Length.—Female, about 1 mm.; male, smaller.

Characters.—Body a golden yellow hue in fresh specimens, with a chestnut-colored transverse band across the anterior part of the genital segment. Fifth pair of legs of female with a rounded oval distal segment, with six marginal setæ (fig. 12b); inner expansion of proximal joint very large and broad, foliaceous, extending beyond the tip of the distal segment, and marked inside the inner edge with a regular row of short transverse chitinous stripes. Ovisac large. The fifth pair of legs of the female especially characterize this species.

Occurrence.—Collected among algæ with a birge net, at Little Harbor, Woods Hole, July, sandy bottom, at about 12 feet depth. Not heretofore reported from American shores.

Distribution.—British seas (Brady); coast of France (Canu); Mediterranean (Claus); Red Sea (Claus); Franz Josef Land (T. Scott); Norwegian and Finnish coasts.



FIG. 12.—DACTYLOPUSIA THISBOIDES. a, FIFTH FOOT OF MALE; b, FIFTH FOOT OF FEMALE.

DACTYLOPUSIA VULGARIS Sars.

Dactylopus stromi CLAUS, Die Freilebenden Copepoden, 1863, p. 126, figs. 1–6.

Dactylopusia vulgaris G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 128, pl. 79, figs. 1–6.

Length.—Female, 0.7 mm.

Characters.—Color, dark yellow to olivaceous brown. Cephalic segment fully as long as the four succeeding ones combined. Anterior antennæ of moderate length, and nine-segmented. Fifth legs of female with their distal segments broadly ovate (fig. 13a), narrowly

pointed at tip, which carries two setæ, the outer of which is weak, and not more than half the length of the other. Three outer marginal spine-like setæ and one inner one. Inner expansion rather large and extending about as far as the distal segment and armed with five terminal spine-like setæ. Fifth legs of male with a shorter distal segment, which is also provided with an additional seta inside, while the proximal segment carries but three terminal spine-like setæ instead of five.

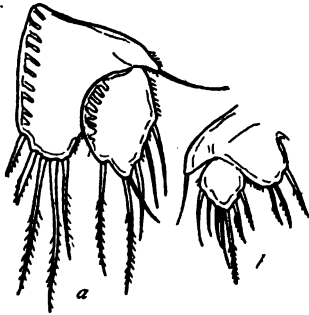


FIG. 13.—*DACTYLOPUSIA VULGARIS*. *a*, FIFTH FOOT OF FEMALE (AFTER SARS); *b*, FIFTH FOOT OF MALE.

Occurrence.—Collected with birge net at Little Harbor, Woods Hole, Massachusetts, among surface algæ, July. Also brackish ponds near Woods Hole, July, and among *Fucus* along the U. S. Fisheries wharf, July. Common.

Distribution.—British Isles (Brady); coast of France (Canu); Heligoland (Claus); Charlestown Pond, Rhode Island (Williams).

Family DIOSACCIDÆ.

Genus DIOSACCUS Boeck, 1872.

DIOSACCUS TENUICORNIS (Claus).

Dactylopus tenuicornis CLAUS, Die Freilebenden Copepoden, 1863, p. 127, pl. 16, figs. 17-23.

Diosaccus tenuicornis BRADY, Copepoda of the British Islands, vol. 2, 1880, p. 68, pl. 59, figs. 12-16.—G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 146, pls. 89 and 90.

Length.—Female about 0.8 mm.; male slightly smaller. Color a golden yellow in life.

Female.—Cephalic segment more than twice as long as all the free segments of the metasome combined. Rostrum very prominent. Furca closely set, the rami slightly longer than broad at base, their apical setæ nearly parallel. Anterior antennæ unusually slender. Fifth pair of legs (fig. 14*b*) with the distal segment oblong in form and armed on its outermost edge with six rather unequal setæ. Inner expansion of proximal segment considerably produced, narrow linguiform in shape, and extending beyond the distal segment; armed with five marginal setæ, the middle one very thick, the others thick and spinous. Two ovisacs, pyriform, and somewhat divergent.

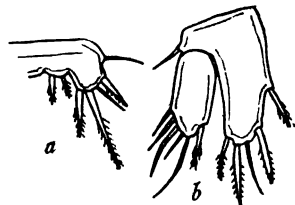


FIG. 14.—*DIOSACCUS TENUICORNIS*. *a*, FIFTH FOOT OF MALE; *b*, FIFTH FOOT OF FEMALE.

Male.—Anterior antennæ prehensile. Fifth legs as in fig. 14a.

Occurrence.—Collected with birge net among algæ, Eel Pond, Woods Hole, August.

Distribution.—British Isles (Brady); Mediterranean (Claus); coast of Bohusland (Cleve); Wickford and Charlestown Pond (Williams); Liverpool Bay (Thompson).

Family LAOPHONTIDÆ.

Genus LAOPHONTE Philippi, 1840.

LAOPHONTE LONGICAUDATA Boeck.

Laophonte longicaudata BOECK, Forh. Vid. Selsk. Christiana, 1864, p. 279.—BRADY Copepoda of the British Islands, vol. 2, 1880, p. 82, figs. 1-10.—G. O. SARS, Crustacea of Norway, vol. 5, 1903, p. 243, pl. 164.

Length.—Female, 0.73 mm..

Characters.—Body of whitish color, with three light orange transverse bands, the first across the cephalic segment, the second occupying the posterior part of the genital segment, the third the anal segment..

Body of female rather slender, with long and slender caudal rami, which equal in length the last two segments combined, and extend straight behind. Anterior antennæ about half the length of the cephalic segment, and seven-segmented. Fifth pair of legs of the female small, distal segment narrow, oval in form, with a straight inner edge, also five terminal setæ. Inner expansion of proximal segment short and broad (fig. 15a), with five marginal setæ, the apical one the longest. Male, fifth leg as in fig. 15b.



FIG. 15.—LAOPHONTE LONGICAUDATA. a, FIFTH FOOT OF FEMALE; b, FIFTH FOOT OF MALE.

Occurrence.—Collected with a birge net just off the Bureau of Fisheries wharf, Woods Hole, Massachusetts, July.

Distribution.—British seas (Brady); Norwegian coast (Sars); Franz Josef Land (Scott). Not heretofore reported from the western Atlantic.

Family LICHOMOLGIDÆ.

Genus LICHOMOLGUS Thorell, 1859.

LICHOMOLGUS FUCICOLUS Brady.

Lichomolgus fucicolus BRADY, Copepoda of the British Islands, vol. 2, 1880, p. 41, pl. 85, figs. 1-11.—THOMPSON, Trans. Liverpool Biol. Soc., vol. 7, 1893, p. 33, figs. 1-3.

Length.—Female, 1.3 mm.; male, 1 mm.

Characters.—Color dark brown. Free swimming. Second antenna (fig. 16a) three-segmented, bearing a few marginal setæ, and at the apex of the third segment four long and one short seta, and a most

remarkable large falciform serrated claw, which is one-half as long as the antenna. Fifth legs (fig. 16c) of a single long curved segment, with two apical setæ. Female with two egg sacs.

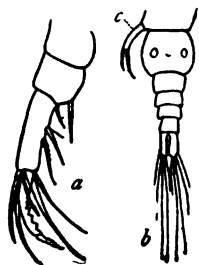


FIG. 16.—*LICHOMOLGUS FUCICOLUS*. a, SECOND ANTENNA OF FEMALE; b, ABDOMEN OF FEMALE; c, FIFTH FOOT.

Occurrence.—Collected in surface net at Buzzards Bay, Woods Hole, July.

Distribution.—British seas (Brady); Liverpool Bay (Thompson); Narragansett Bay (Charlestown Pond), Rhode Island (Williams).

Family TACHIDIIDÆ.

Genus *TACHIDIUS* Lilljeborg, 1853.

TACHIDIUS BREVICORNIS (Müller).

Cyclops brevicornis MÜLLER, Zool. Dan. Prodr., 1776, p. 414; Entomostraca, 1785, p. 118.

Tachidius brevicornis CLAUS, Die Freilebenden Copepoden, 1863, p. 112, figs. 1-8.—

BRADY, Copepoda of the British Islands, vol. 2, 1880, p. 20, figs. 1-16.—

THOMPSON, Trans. Liverpool Biol. Soc., vol. 7, 1893, p. 18, figs. 1-2.

Length.—About 1.65 mm.

Characters.—Body robust, with a short rostrum. Body segments fringed on their posterior margins with rows of minute teeth. Fifth pair of feet in both sexes (fig. 17a,b) broad, one-segmented, subquadrate, longer in female than in male. A typical inhabitant of warm, brackish pools.

Occurrence.—Collected by a birge net from a brackish pool near Old Mill, Jamaica Bay, Long Island, June.

Distribution.—British seas (Brady and Thompson); Charlestown Pond, Rhode Island (Williams).



FIG. 17.—*TACHIDIUS BREVICORNIS*. a, FIFTH FOOT OF FEMALE; b, FIFTH FOOT OF MALE.

Family ILYOPSYLLIDÆ.

First antennæ very short, five-to-six segmented, basal segment greatly dilated. Second antennæ stout, dactyl-like, and destitute of a secondary branch. Mandible small, and bearing a simple bisetose palp. First pair of feet stout, strongly spined, with an outer branch which is indistinctly two-segmented, and an inner branch which is three-segmented. Second, third, and fourth pairs with both rami three-segmented. Fifth feet plate-like, inconspicuous, and with lobed margins. Abdomen short, and tapering toward the extremity; caudal setæ commonly distinctly spathulate.

Remarks.—The members of this group seem so very distinct from other known Harpacticoids as to merit the formation of this family. At present, the characters of the genus *Ilyopsyllus* are those of the family. Brady (1880, p. 145) was unable to find any evidences of fifth feet, therefore this is omitted from the original description of this genus.

Genus *ILYOPSYLLUS* Brady and Robertson, 1873.

ILYOPSYLLUS SARSI, new species.

Length of female exclusive of caudal setæ, 0.5 mm. Male unknown. Color deep blood red.

Seen from the side (fig. 18*b*) the ventral line is nearly straight, while the cephalic region is very unusually arched. First segment of the

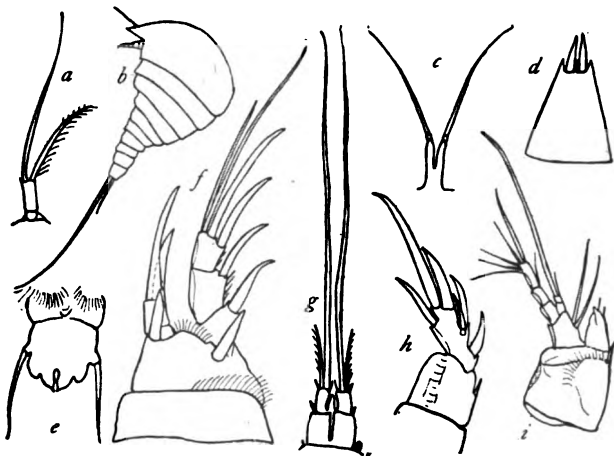


FIG. 18.—*ILYOPSYLLUS* SARSI. *a*, MANDIBULAR PALP. $\times 250$; *b*, LATERAL VIEW OF FEMALE $\times 70$; *c*, MAXILLIPEDS $\times 250$; *d*, ROSTRUM $\times 250$; *e*, FIFTH FOOT OF FEMALE; *f*, FIRST FOOT OF FEMALE $\times 250$; *g*, FURCAL RAMI OF FEMALE $\times 250$; *h*, SECOND ANTENNA OF FEMALE $\times 250$; *i*, FIRST ANTENNA OF FEMALE $\times 250$.

cephalothorax about one-half length of body. Abdominal segments armed posteriorly with a row of small spinules, with one or two larger spines at the outer angles. Rostrum (fig. 18*d*) large, triangular, and armed at tip with two movable spines. First antenna (fig. 18*i*) six-segmented, the first segment very large and with a semicircular row of spinules at its inner distal angle. Second segment very short, and produced into a broad, blunt, somewhat beak-like process, which is fully as long as the third segment. Third segment slightly longer than broad, and bearing a very long aesthetask, which is supported on a two-segmented base, and is about twice as long as the four last segments of the antenna taken together. Fourth and fifth segments small, about as wide as long, terminal segment slightly longer and bearing a number of setæ.

Second antenna (fig. 18h) three-segmented, broad, strong, and dactyl-shaped, its terminal segment about twice as long as wide and armed with six strong spines, one of which is situated on the face of the segment, and is somewhat inconspicuous. Mandibular palp (fig. 18a) with a two-segmented base, and bearing two bristles at its tip, one plumose and about twice as long as the base, the other longer and simple.

The maxillipeds are as in fig. 18c. First leg (fig. 18f) with a basal part of two broad segments, the first one over three times as broad as long and bearing a semicircular row of spinules at its outer distal margin. Second segment irregular in shape, with a heavy plain spine at each distal angle, and a semicircular row of spinules between the bases of the two rami. Outer ramus three-segmented, and more than twice as long as the inner one, each segment with a large spine on its outer distal angle, and the terminal segment with an extra spine and two slender setæ. Inner ramus indistinctly two-segmented, the terminal segment with two strong plain spines. Second to fourth feet alike, with both rami three-segmented, and with many long plumose setæ.

Fifth foot (fig. 18e) slightly longer than wide, and in the form of a plate, with a seta on each lateral margin, which is slightly longer than the foot. Its distal margin is four-lobed, with the deepest indentation in the middle. Basal portion with two semicircular rows of spinules.

Furcal rami (fig. 18g) slightly longer than wide, each with a very short inner seta, a dorsal seta, and two large terminal setæ, the outer of which is about one-seventh as long as the inner and plumose exteriorly, while the inner is fully as long as the body, but very slightly spatulate at base, and with very delicate tips.

Named for Dr. G. O. Sars.

Remarks.—This species at first glance superficially somewhat resembles *I. natans* Williams, but differs markedly in color, in shape of rostrum, size, and shape of projection of second segment of first antenna, character of armature of terminal segment of second antenna, first leg with two terminal setæ and two spines, instead of one terminal seta and two spines, comparative lengths of terminal setæ of furca, and shape of fifth foot; it having four lobes, which are of different sizes and shapes, instead of being regularly six-lobed.

But four other species of this genus are known to the writer—*I. affinis* Scott (Gulf of Guinea), *I. coriaceus* Brady and Robertson (British seas and coast of France), *I. holothuriæ* (Edwards), and *I. natans* Williams (Narragansett Bay, Mill Cove, Wickford).

Occurrence.—Collected plentifully with a birge net among floating algæ in Eel Pond and Little Harbor, Woods Hole, Massachusetts, July, August; also brackish ponds, Woods Hole.

Type.—Cat. No. 39512, U.S.N.M.

SYNOPSIS OF THE GENERA OF HARPACTICOIDA.

- Inner ramus of fourth leg three-segmented. *Alteutha*, *Ameira*, *Ameiropsis*, *Amenophia*, *Amphiascus*, *Aspidiscus*, *Bradya*, *Canuella*, *Cerviniopsis*, *Dactylo-*
podella, *Dactylopusia*, *Danielssenia*, *Delavalia*, *Diosaccus*, *Ectinosoma*, *Euca-*
nuella, *Eupelte*, *Euterpe*, *Halkithalestris*, *Harpacticus*, *Herdmania*, *Hermanella*,
Hersiliodes, *Idomene*, *Idya*, *Idyella*, *Idyopsis*, *Ilyopsyllus*, *Longipedia*, *Mach-*
airopus, *Microsetella*, *Microthalestris*, *Misophria*, *Nitocra*, *Onychocamptus*,
Parameira, *Parastenhelia*, *Parategastes*, *Parathalestris*, *Parawestwoodia*,^a *Pelti-*
dium, *Phyllothalestris*, *Porcellidium*, *Psamathe*, *Pseudobradya*, *Pseudothalestris*,
Robertsonia, *Rhynchothalestris*, *Stenhelia*, *Stenocopia*, *Sunaristes*, *Tachidius*,
Tegastes, *Thalestris*, *Tigriopus*, *Zaus*, *Zosime* A.
- Inner ramus of fourth leg two-segmented. *Asellopsis*, *Attheyella*, *Canthocamp-*
tus, *Cervinia*, *Ceylonia*, *Cletodes*, *Cylindropsyllus*, *Enhydrosoma*, *Heteropsyllus*,
Laophonte, *Laophontodes*, *Laophontopsis*, *Leptosyllus*, *Lichomolgus*, *Maren-*
biotus, *Mesochra*, *Moraria*, *Normanella*, *Paralichomolgus*, *Paratachidius*, *Phyl-*
lopodopsyllus, *Pseudolichomolgus*, *Stenheliopsis*, *Tetragoniceps* B.
- Inner ramus of fourth leg one-segmented. *Laophontella*, *Pontopolites*,
Pseudanthessius C.
- Inner ramus of fourth leg rudimentary, of a few spines or missing. *Dyspontius*,
Nannopus, *Platychelipus* D.
- D Inner ramus of third leg three-segmented. No fifth legs. On weed, 20 to 40
fathoms *Dyspontius*.
- Inner ramus of third leg rudimentary D 1.
- D 1. Both rami of the first leg two-segmented. Muddy bottoms between tides.
Platychelipus.
- Both rami of the first leg not two-segmented, the outer of three segments, the
inner of two segments. Muddy bottoms, brackish pools *Nannopus*.
- C. Inner ramus of third leg one-segmented to rudimentary. Bottom, 10 to 20
fathoms *Pontopolites*.
- Inner ramus of third leg more than one-segmented C 1.
- C 1. Inner ramus of third leg three-segmented. Littoral, Indian Ocean.
Pseudanthessius.
- Inner ramus of third leg two-segmented. Littoral, Indian Ocean. *Laophontella*.
- B. Inner ramus of second and third leg rudimentary or obsolete. Bottom forms;
mud. Males unknown *Leptopsyllus*.
- Inner ramus of third leg two- or three- segmented B 1.
- B 1. Inner ramus of third leg three-segmented B 2.
- Inner ramus of third leg two-segmented. One egg sac B 7.
- B 2. Fifth pair of legs two-segmented. One egg sac B 3.
- Fifth pair of legs one-segmented. Two egg sacs B 6.
- B 3. Inner ramus of first leg forming a powerful claw, two-or-three segmented.
Body regions sharply defined. Moderate depths, amongst algæ. *Laophonte*.
- Inner ramus of first leg normal, not forming a powerful claw B 4.
- B 4. Inner ramus of second and third legs normal, not modified in any way. Fresh-
water ponds and streams. Bottom forms amongst debris and algæ.
Canthocamptus (female).
- Inner ramus of first, second, or third legs may be modified B 5.
- B 5. Inner ramus of but the third leg modified. Freshwater lakes, ponds, etc.
as *Canthocamptus* *Attheyella* (male).
- Inner rami of the first, second, and third legs, or the second and third legs
modified *Canthocamptus* (male).

^aThe old name *Westwoodia* Dana 1855, preoccupied in Hymenoptera. The name *Parawestwoodia* here supplied.

- B 6. Anterior antennæ six- or seven-segmented. Free swimming in plankton, or in the branchial sacs of Ascidians..... *Lichomolgus*.
Anterior antennæ three-segmented. Otherwise as *Lichomolgus*. Washings from dredgings, Indian Ocean..... *Paralichomolgus*.
- B 7. Inner ramus of first leg three-segmented..... B 8.
Inner ramus of first leg two-segmented..... B 10.
- B 8. First antenna not more than five-segmented. Fifth legs two-branched, foliaceous. One egg sac. Males unknown. Moderate depths..... *Heteropsyllus*.
First antenna more than five-segmented, seven- to nine-segmented..... B 9.
- B 9. Caudal rami long and narrow, discontinuous. First antenna seven-segmented. Fifth legs two-segmented, the basal segment scarcely wider than the terminal one. Inner rami of second, third, and fourth legs two-segmented, more or less modified. One hundred fathoms or more..... *Cervinia*.
Caudal rami short and broad. First antenna nine-segmented. Tidal pools amongst algæ..... *Paratachidius*.
- B 10. Rostrum anchor-shaped, of three strong spines, the two outer ones slightly curved outward at end. Towsings, Puget Sound... *Pseudolichomolgus* (male).
Rostrum not anchor-shaped or of three spines..... B 11.
- B 11. Fifth legs one-segmented, sometimes plate-like..... B 12.
Fifth legs two-segmented..... B 18.
- B 12. Fifth legs forming enormous concave plates which serve for holding ova. Male unknown. Muddy bottom, 10 to 30 fathoms..... *Phyllopodopsyllus*.
Fifth legs normal, not used for holding ova..... B 13.
- B 13. Basal segment of all the legs, elbow-like. Fifth legs long and narrow. Littoral, 10 to 30 fathoms..... *Laophontodes* (male).
Basal segment of all the legs, not elbow-like, normal..... B 14.
- B 14. Furcal rami long and narrow, strongly divergent. Fifth leg plate-like. Two egg sacs. Male unknown. 50 fathoms, muddy bottom..... *Stenheleipsis*.
Furcal rami, normal, fifth legs variously shaped..... B 15.
- B 15. Anterior antennæ five-segmented..... B 16.
Anterior antennæ seven- to eight-segmented..... B 17.
- B 16. Body almost exactly cylindrical, about eleven times as long as wide. Anterior and posterior maxillipeds claw-like. (Parasitic?.) Fifth leg narrow. Littoral. Muddy bottoms, 5 to 15 fathoms..... *Cylindropsyllus*.
Body subcylindrical, about seven times as long as wide. Fifth leg broad. Littoral, 10 to 30 fathoms..... *Enhydrosoma* (male).
- B 17. Fifth leg plate-like and two-lobed. Inner rami of third legs modified. Oyster washings, Indian Ocean..... *Ceylonia* (male).
Fifth leg much longer than wide. Second maxilliped forming a prehensile clawed hand. Littoral, muddy bottoms..... *Tetragoniceps* (female).
- B 18. Outer rami of first legs two-segmented..... B 19.
Outer rami of first legs three-segmented..... B 20.
- B 19. First legs prehensile. Body depressed. Caudal rami lamellar, apical setæ rudimentary. Inner ramus of third leg transformed in male. Littoral... *Asellopsis*.
First legs not prehensile. Body subcylindrical. Caudal rami not lamellar. Inner ramus of third leg transformed in male. Fresh water. One egg sac, *Marzenbiotus*.
- B 20. First legs prehensile..... B 21.
First legs not prehensile..... B 25.
- B 21. Basal segment of inner ramus of first leg with no seta on its inner margin. Rostral plate not well defined at base..... B 22.
Basal segment of inner ramus of first leg with a seta. Rostral plate well defined at base. Inner rami of first leg always two-segmented. One egg sac..... B 23.

- B 22. Body cylindrical, no conspicuous constrictions between the segments. Natatory legs normal, but inner rami of first legs two- to three-segmented. Inner rami in third legs modified in male. One egg sac. Brackish pools and ditches *Mesochra*.
Body abnormal, with decided constrictions between its segments. Natatory legs bent, elbow-like. 10 to 30 fathoms..... *Laophontodes* (female).
- B 23. First antenna four- to five-segmented, stout. Furca lamellar. Both segments of fifth feet especially narrow. 6 to 10 fathoms, muddy bottoms. *Laophontopsis*.
First antenna of seven segments..... B 24.
- B 24. Inner ramus of first leg much longer than the outer. Fifth legs not foliaceous, but rather narrow. Furca normal. Bottom forms, pelagic..... *Normanella*.
Inner ramus of first leg shorter than the outer, with an odd rod-like projection from its basal segment. Fifth legs foliaceous. Furca with a large thick terminal spine, and a few setæ. Bottom washings, pelagic. *Ceylonia* (female).
- B 25. Anterior antenna four- to six-segmented. One egg sac. Marine..... B 26.
Anterior antenna seven- to eight-segmented. One egg sac. Fresh-water.. B 27.
- B 26. Basal segment of fifth foot a broad plate. Terminal segment comparatively short and broad. Pelagic, sandy bottom..... *Enhydrosoma* (female).
Basal segment of fifth foot narrow and produced into a narrow flange. Terminal segment of same very long and narrow. Pelagic, muddy sand..... *Cletodes*.
- B 27. Anterior antenna eight-segmented, the terminal part of four segments. Inner rami of first legs two- or three-segmented. Littoral and bottom. *Attheyella* (female).
Anterior antenna seven-segmented, the terminal part of three segments. Inner rami of first legs always two-segmented. Bottom..... *Moraria*.
- A. Inner ramus first leg one-segmented A 1.
Inner ramus first leg two- or three-segmented A 6.
- A 1. Outer ramus of first leg three-segmented, strongly spined..... A 2.
Outer ramus of first leg one-segmented..... A 3.
- A 2. Fifth legs very minute, plate-like, and lobed on distal margin. First antennæ five-segmented; basal segments much dilated. Body tumid and gibbous. Littoral. 5 to 20 fathoms. Algæ..... *Ilyopsyllus*.
- A 3. Outer rami of the second, third, and fourth legs three-segmented A 4.
Outer rami of the second, third, and fourth legs two-segmented A 5.
- A 4. First legs imperfectly prehensile. Fifth foot of male one-segmented; of female, two-segmented. No true ovisac. Head and last thoracic segment very large, produced ventrally. 3 to 30 fathoms. Sandy bottom..... *Tegastes*.
- A 5. First legs not prehensile. Otherwise much as *Tegastes*..... *Parategastes*.
- A 6. Inner ramus of first legs two-segmented A 7.
Inner ramus of first legs three-segmented..... A 24.
- A 7. Outer rami of first legs two-segmented. One egg sac..... A 8.
Outer rami of first legs three-segmented..... A 10.
- A 8. Fifth legs two-segmented; first legs prehensile..... A 9.
Fifth legs one-segmented; first legs not prehensile; inner rami peculiarly bent at right angles, and with natatory setæ. One egg sac. Pelagic, in towings. *Euterpe*.
- A 9. Outer rami of first legs shorter than the inner. Body not flattened. First antenna eight-segmented. Tidal pools, or "tidal lagoons"..... *Pseudothalestris*.
Outer rami of first legs longer than the inner. Body flattened, broad. Littoral, amongst algæ and in tidal pools, or lagoons..... *Zaus* (mostly).
- A 10. Rami of first legs enormously broadened, flattened, and otherwise modified. Body short and flat. Furca lamellate, with rudimentary setæ. Fifth legs two-segmented. Littoral, on *Laminaria*, etc..... *Porcellidium*.
Rami of first legs not unusually modified or developed..... A 11.

- A 11. Fifth legs one-segmented A 12.
 Fifth legs two- to four-segmented A 13.
- A 12. First leg not prehensile. Caudal setæ modified. One egg sac. Muddy bottoms, 20 fathoms *Zosime*.
 First leg prehensile. Inner rami of second legs three-segmented, modified.
 Fifth leg an inconspicuous plate in male. Two egg sacs. 3 to 30 fathoms.
 Muddy bottoms or algæ *Stenhelis* (part).
- A 13. Fifth leg four-segmented; first antenna nine-segmented A 14.
 Fifth leg less than four-segmented A 15.
- A 14. Outer ramus first leg with segments approximately same length. Inner rami alike in sexes. Washings from muddy dredgings *Parastenhelia* (male).
 Outer ramus first leg with the middle segment much the larger. Inner ramus of third leg unlike in the sexes. Not more than 0.5 mm. long. Littoral, among algæ *Microthalestris* (male).
- A 15. Fifth foot three-segmented A 16.
 Fifth foot two-segmented A 17.
- A 16. Furca extremely long and narrow. First leg not prehensile, but terminal segment with a finger-like projection. First antenna nine-segmented. Pelagic, muddy bottoms *Herdmania* (male).
 Furca not extremely long and narrow. First leg prehensile. Body depressed. Littoral, 2 to 20 fathoms *Eupelte*.
- A 17. Fifth legs narrow, linear A 18.
 Fifth legs not narrow and linear. Basal segment much expanded A 20.
- A 18. Body short, oval, and much flattened. Furca not reaching beyond posterior expansions of body segments, and narrow. Inner segments of first legs broad. Littoral, sandy bottom *Peltidium*.
 Body not oval and much flattened A 19.
- A 19. Furca very long and narrow. First foot not prehensile, but terminal segment with a finger-like projection. First antenna nine-segmented. Muddy bottoms, 30 to 40 fathoms *Herdmania* (female).
 Furca not very long and narrow. First foot prehensile, the basal segment very broad, the terminal one narrow. First antenna eight-segmented. Somewhat like *Cyclops*. 10 to 30 fathoms, muddy bottom *Idyella*.
- A 20. First antenna five-segmented. First leg not prehensile. Inner ramus of second leg two-segmented in male and modified; three-segmented in female. One egg sac. Brackish mouths of rivers, and pelagic *Danielssenia*.
 First antenna six- to nine-segmented. First feet prehensile A 21.
- A 21. Inner ramus of second legs two-segmented, modified in male, also with a spine. Body dilate and depressed in front. First antenna six-segmented. 6 to 20 fathoms, among algæ and hydroids *Dactylopodella*.
 Inner ramus of second legs not modified in the sexes A 22.
- A 22. Inner rami first legs shorter than the outer rami. Two egg sacs. First antenna eight-segmented. Brackish pools, muddy bottom *Delavalia*.
 Inner rami first legs longer than the outer rami A 23.
- A 23. Outer rami of first legs with the three segments about the same size. Inner rami of all legs alike in the sexes. Washings from muddy dredgings.
Parastenhelia (female).
 Outer rami of first legs with the middle segment much the longest of the three. Not more than 0.6 mm. long. Inner ramus of third leg modified in male. Littoral, among algæ *Microthalestris* (female).
- A 24. Outer rami of first leg one- to two-segmented. Prehensile A 25.
 Outer rami of first leg always three-segmented A 28.
- A 25. Outer rami of first legs longer than the inner A 26.
 Outer rami of first legs shorter than the inner (one-segmented in *Paravestwoodia nobilis*) A 27.

- A 26. Body slender and not flattened. First antenna eight-segmented. Inner ramus second leg modified in male. Outer ramus third leg large and robust, spiny and prehensile. One egg sac. Littoral to 100 fathoms. *Harpacticus*. Body slender, oblong, and much flattened, lateral plates produced. First antenna five-segmented. 20 to 30 fathoms..... *Zaus goodsiri*.
- A 27. Basal segment of inner ramus very long, several times as long as the last two segments taken together. One egg sac. Littoral, tidal pools among algæ. *Parawestwoodia*. Basal segment of inner ramus very short, but a small proportion of the inner ramus. Two egg sacs. Fifth foot of male of two separate lobes. Fresh-water pools as with *Diaptomus* and *Canthocamptus*..... *Onychocamptus*.
- A 28. Fifth legs three-segmented. First legs not prehensile, but as *Cyclops*. First antenna sixteen-segmented, that of male somewhat less. One egg sac. 20 to 50 fathoms, sandy bottom..... *Misophria*. Fifth legs less than three-segmented..... A 29.
- A 29. Fifth legs of a small setiferous lamella..... A 30. Fifth legs from one-to two-segmented..... A 33.
- A 30. First foot slightly prehensile. First pedigerous segment separated from the cephalothorax. Genital segment with a dorsal suture. Two egg sacs. 10 fathoms, sandy bottom, algæ..... *Canuella*. First foot not at all prehensile. No transverse dorsal suture of genital segment of female. First pedigerous segment not separated from cephalothorax... A 31.
- A 31. First antenna eight-segmented. Body like *Cyclops*. Inner ramus of second leg modified, two-segmented. 3 to 30 fathoms, mostly muddy bottom. *Stenhelina* (male, part). First antenna, six- to seven-segmented..... A 32.
- A 32. Outer ramus of second antenna six-segmented. Body slender, not compressed. But trace of a seta on middle segment of inner ramus of fourth legs. Inner rami of second legs modified in male. Two egg sacs. A few fathoms, sandy bottoms (shells of hermit crabs)..... *Sunaristes*. Outer ramus of second antenna three-segmented, but well developed. Anterior part of body somewhat depressed and broadened. A well developed seta on middle segment of inner ramus of fourth legs. One egg sac. Males unknown. 10 to 30 fathoms, sandy bottom..... *Bradya* (in part).
- A 33. Fifth legs one-segmented..... A 34. Fifth legs two-segmented..... A 37.
- A 34. Fifth foot an oval setiferous segment in both sexes, about as broad as long. One egg sac. Inner ramus of second leg modified in male. Brackish marsh pools and bays..... *Tachidius*. Fifth foot longer than broad..... A 35.
- A 35. Body like *Cyclops*. Genital segment much broader than the preceding one. Antennæ much as *Cyclops*. Two egg sacs. Surface net and washings. A 36. Body *Canthocamptus*-like, genital segment not distinctly broader than the preceding segment. Antennæ much as *Canthocamptus*. Two egg sacs. 3 to 30 fathoms, mostly mud bottom, occasionally algæ. *Stenhelina* (male, partly).
- A 36. Anterior half of body almost circular. Second segment of first antenna much the longest. Washings from sponges, etc. (Indian Ocean)..... *Hermanella*. Anterior half of body about one-half as wide as long. Second segment of first antenna not the longest. Surface net and washings (Indian Ocean). *Hersiliodes*.
- A 37. Fifth foot with terminal segment trilobate, each lobe with a spine, and inner expansion of basal segment always with two spines, as in text fig. 7. Body slender, fusiform. Readily float on surface film. One egg sac. 10 to 30 fathoms, muddy bottom..... *Ectinosoma*. Fifth foot not trilobate, and inner expansion of basal segment not with two spines..... A 38.

- A 38. Terminal segment of second leg enormously lengthened. First legs partly prehensile. First antenna five-segmented. One ovisac. Muddy bottoms. 6 to 30 fathoms *Longipedia*.
 Terminal segment of second leg unusually lengthened. First antenna six- to nine-segmented..... A 39.
- A 39. Basal segment of inner ramus of first leg enormously broadened. First leg otherwise modified..... A 40.
 Basal segment of inner ramus of first leg not enormously broadened. First leg normal..... A 43.
- A 40. Posterior part of body not so sharply demarcated from the anterior part as to approximately equal width of the abdomen. Body much depressed. Basal segment of inner rami of first leg very broad and triangular, and as long as the outer ramus. One egg sac. 6 to 20 fathoms, adhering to debris, etc. *Idomene*.
 Posterior part of body sharply and abruptly demarcated from the anterior part, with abdomen approximately one-third width of segment just anterior to it. Body more or less depressed. First antenna eight- to nine-segmented. One egg sac..... A 41.
- A 41. Middle segment of inner ramus of third and fourth legs, with two setæ each. Anterior part of body broad. Sublittoral, closely clinging to fronds of algae, as *Laminaria* *Psamathe*.
 Middle segment of inner ramus of third and fourth legs, with one seta each. A 42.
- A 42. Middle segment of outer ramus armed with a strong, claw-like spine curving outward. Littoral, amongst algæ *Machairopus*.
 Middle segment of outer ramus not armed with a strong, claw-like spine curving outward. Fifth legs long and narrow. The two segments preceding genital segment, fornicate posteriorly. Sublittoral, closely clinging to fronds of *Laminaria*..... *Aspidiscus*.
- A 43. Caudal rami, long, narrow, linear, and so contiguous as to almost appear as a single appendage. Genital segment in female produced on each side to a recurved, spiniform projection. First antenna six-segmented, with a long fusiform appendage from the fourth segment. One egg sac. Male unknown. Great depths, loose muddy deposits..... *Cerviniopsis*.
 Caudal rami, not long, narrow, and so contiguous as to appear as a single appendage..... A 44.
- A 44. Both rami of first legs natatory, as those of the natatory legs, not prehensile. One egg sac..... A 45.
 Both rami of first legs not natatory, one or both prehensile. One or two egg sacs..... A 48.
- A 45. Basal segment of first leg with three large accessory spines, one of which is situated on the face of the segment, the others on the margins. Abdomen distinctly separated from the thorax. Inner branch of second antenna two-segmented. Inner ramus second legs modified in male. 20 to 30 fathoms, muddy bottom..... *Robertsonia*.
 Basal segment of first leg normal, with no accessory spines..... A 46.
- A 46. Anterior part of body not appreciably broader than the posterior part. Body very slender, linear. The two middle setæ of the furca greatly elongate. Outer branch of second antenna greatly elongate. Pelagic, near the surface, in plankton..... *Microsetella*.
 Anterior part of body appreciably broader than the posterior part..... A 47.

- A 47. Posterior antenna with the outer ramus poorly developed, and occasionally of only two segments. Anterior part of body slightly depressed and broadened. Fifth legs large and alike in the sexes. 3 to 6 fathoms, muddy sand.

Pseudobradya.

Posterior antenna well developed and distinctly three-segmented. Anterior part of body somewhat depressed and broadened. Fifth feet small (in male but one-segmented, a small setiferous lamella). 10 to 30 fathoms, sandy bottom.....

Bradya.

- A 48. Rami of the natatory legs form a decided angle with the segment bearing them. Body depressed, oval, shield-shaped. Rolls up when disturbed. Outer rami of first legs the larger. Fifth legs falciform, alike in the sexes. Furca short, broad, and lamellar. Littoral, on *Laminaria* and other algæ, and on sandy and gravelly bottoms, 2 to 20 fathoms.....

Alteutha.

Rami of the natatory legs not forming a decided angle with the segment bearing them.....

A 49.

- A 49. Outer rami of the first legs somewhat longer than the inner rami..... A 50.
Outer rami of the first legs somewhat shorter than the inner rami, or occasionally subequal. (*Thalestris* and *Parathalestris* variable)..... A 55.

- A 50. Middle segment of inner rami of fourth legs with no setæ on inner margin, one seta in similar location of other natatory legs. Inner rami of second legs modified in male. One egg sac. Rock and tidal pools and occasionally in fresh water in-shore.....

Tigriopus.

Middle segment of inner rami with at least one seta. One egg sac.....

A 51.

- A 51. Body quite flat and shield-like. No rostrum. Eye present. Middle segment of inner ramus of second legs modified in male. 6 to 20 fathoms, at sea.

Amenophia.

Body not flat nor shield-shaped. Rostrum present.....

A 52.

- A 52. Fifth legs of both sexes foliaceous, those of the female large, more or less covering the egg sac.....

A 53.

Fifth legs of female slender, not covering the egg sacs. Male unknown. Genital segment of female with a well-developed dorsal suture (transverse), and produced on each side to a strong spiniform projection. Furca somewhat lamellar. Eye absent. First antenna with a very large seta on the fourth segment. 50 to 60 fathoms.....

Eucanuella.

- A 53. Fifth legs of female enormously developed, foliaceous, wholly covering the egg sacs. Genital segment in female with a well-marked dorsal transverse suture, and not produced on each side to a strong spiniform projection. Eye large and complicated. Inner rami of second legs modified in male. Among algæ, 6 to 20 fathoms.....

Phyllothalestris.

Fifth legs not enormously developed, and commonly not covering the egg sacs.....

A 54.

- A 54. Rostrum sharply defined from the cephalic shield, and partially mobile. Body slender, cylindrical, and somewhat laterally compressed, fifth legs of moderate size. Littoral and tidal pools, among algæ.....

Parathalestris.

Rostrum not defined at base, short, thick, and immobile. Body robust. Rami of first legs subequal in length. Fifth legs large. Littoral, 10 to 20 fathoms, in algæ.....

Thalestris.

- A 55. Inner margins of middle segments of inner rami of the natatory legs with 2 setæ each. One egg sac.....

A 56.

Inner margins of middle segments of inner rami of the natatory legs not with 2 setæ each.....

A 58.

- A 56. Basal segment of inner ramus of first leg not larger than the rest of the ramus. Body more or less depressed. Spines of outer rami of first legs with long cilia. Eye normal. Littoral and pelagic..... *Idya*.
 Basal segment of inner ramus of first leg longer than the rest of the ramus. Inner ramus of second leg modified in male. Eye present..... A 57.
- A 57. Rostrum very prominent and very mobile. Body divisions sharply marked off from one another. First antennæ nine-segmented. Spines of outer rami of natatory legs coarsely denticulate. 6 to 20 fathoms, *Laminaria* and other algæ..... *Rhynchothalestria*.
 Rostrum not unusually prominent and mobile. Body divisions not unusually well marked. Body stout. First antennæ five- to nine-segmented. Spines of outer rami of natatory legs commonly plain, not coarsely denticulate. Littoral and tidal pools, among algæ..... *Dactylopusia*.
- A 58. Middle segments of inner rami of natatory legs with one seta each. One egg sac..... A 59.
 Middle segments of inner rami of natatory legs not with one seta each, with two on the second and third inner rami, or one on the third and fourth... A 63.
- A 59. Basal segment of inner rami of first leg shorter than rest of ramus. Eye absent. No rostrum. Body short, stout, and cylindrical. 20 to 30 fathoms, muddy bottom..... *Parameira*.
 Basal segment of inner rami of first leg longer than the rest of the ramus. Inner rami of second leg not modified in male. One egg sac..... A 60.
- A 60. Caudal rami long and narrow, ten to twenty times as long as wide. Rami of natatory legs long and narrow. Body slender. Rostrum small. Eye absent. Last two segments of inner rami of first legs, more or less bent on the first. 30 to 50 fathoms, muddy bottom..... *Stenocopia*.
 Caudal rami not long and narrow, not more than one to five times as long as wide. Eye present..... A 61.
- A 61. Outer rami of second antennæ two-segmented. Rostrum small, but distinct. Body slender. First two segments of first antenna much the larger. Basal segments of inner rami of first leg longer than the outer rami. Moderate depths among algæ..... *Ameiropsis*.
 Outer rami of second antennæ one-segmented. Body slender. Rostrum small..... A 62.
- A 62. Caudal rami scarcely spinulose. Anal opercle perfectly smooth. Moderate depths among algæ, rarely littoral..... *Ameira*.
 Caudal rami coarsely spinulose. Anal opercle denticulate. Segments of urosome coarsely spinulose. Strictly littoral, brackish and tidal pools.... *Nitocra*.
- A 63. Middle segment of inner rami of second and third legs, with two setæ each, of fourth pair, one..... A 64.
 Middle segment of inner rami of second legs with two setæ, of third and fourth legs, one each. Inner rami of second legs modified in male. One egg sac..... A 66.
- A 64. Terminal segment of fifth legs long and narrow, not foliaceous. Body short and depressed, its posterior part abruptly much narrowed. Males not known. Rostrum small. One egg sac. Littoral, 10 to 40 fathoms..... *Idyopsis*.
 Terminal segment of fifth legs not long and narrow, foliaceous. Two egg sacs. Rostrum prominent. Inner rami of second legs modified in male..... A 65.
- A 65. Outer rami of second antenna one-segmented. Body compressed in front, attenuate behind. The two segments of the fifth legs of male confluent. Littoral and tidal pools, among algæ..... *Diosaccus*.
 Outer rami of second antenna two-segmented. Body slender, cylindrical. The two segments of fifth legs of male not confluent. Moderate depths among algæ; not littoral..... *Amphiascus*.

- A 66. Caudal rami narrow, prolonged, and very divergent. Body elongate, subcylindrical, with no sharp divisions. Large, from 2.0 to 2.5 mm. long. Truly pelagic, near the surface..... *Halithalestris*.
Caudal rami not narrow, and not divergent; not much longer than wide..A 67.
A 67. Rostrum sharply defined from the cephalic shield, and partially mobile. Body slender, cylindrical, and somewhat laterally compressed. Fifth legs of moderate size. Littoral and tidal pools, among algæ..... *Parathalestris*.
Rostrum not defined at base, short, thick, and not mobile. Body robust. Rami of first legs subequal in length; fifth legs large. Littoral, 10 to 20 fathoms, in algæ..... *Thalestris*.

UNCLASSIFIED.

- Ancorobolus*, new genus, *mirabilis* new species, A. M. NORMAN, Notes on the Nat. Hist. of East Finmark, Ann. Mag. Nat. Hist. (7), vol. 10, 1902, p. 341; vol. 11, 1903, pp. 1-4.
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Pseudolaophonte for *P. aculeata*, off Spanish Head, Isle of Man, A. SCOTT, Proc. Liverpool Biol. Soc., vol. 10, 1896, p. 144.

SYNONYMS.

- Amymone*=*Tegastes*.
Beatricella=*Stenhelia*.
Carillus=*Peltidium*.
Cleta=*Laophonte*.
Cyclopicera=*Dermatomyzon*.
Cylindrosoma=*Cylindropsyllus*.
Dactylopus=*Dactylopusia*.
Evansia=*Tetragoniceps*.
Jonesiella=*Danielssenia*.
Jurinia. Related to *Nannopus*? (See Brady, Copepoda of the British Islands, vol. 2, 1880, p. 101.)
Leptascus=*Tetragoniceps*?
Lilljeborgia=*Cletodes*.
Oniscidum=*Peltidium*.
Ophiocamptus=*Moraria*.
Orthopsyllus=*Cletodes*.
Pseudowestwoodia=*Pseudothalestris*.
Reticulina=*Peltidium*.
Scutellidium=*Psamathe*.
Sterope=*Peltidium*.
Tisbe=*Idya*.
Westwoodia=*Parawestwoodia*^a (new name).

^a Old name *Westwoodia* preoccupied in Hymenoptera.

Order CLADOCERA.

Division GYMNOMERA.

Tribe ONYCHOPODA.

Genus PODON Lilljeborg, 1853.

PODON LEUCKARTI (Sars).

Pleopsis leuckarti Sars, Forh. Vid. Selsk. Christiania, 1861, p. 45.

Podon polyphemoides P. E. MÜLLER, Danmarks Cladocera, 1867, p. 220, pl. 6, figs. 5-6.

Podon leuckarti Sars, Forh. Vid. Selsk. Christiania, 1890, no. 1, p. 14.—LILLJEBORG, Nova Acta Regiæ Soc. Sci. Upsaliensis, ser. 4, vol. 19, 1901, p. 636, pl. 85, fig. 12; pl. 86, fig. 1-3.—APSTEIN, Nordisches Plankton, Cladocera, Kiel, 1901, p. 13, fig. 23.

Female from 0.89 to 1 mm. long, and about two-thirds as high. Males slightly smaller. Seen from the side (fig. 19 *a*, *b*), both sexes

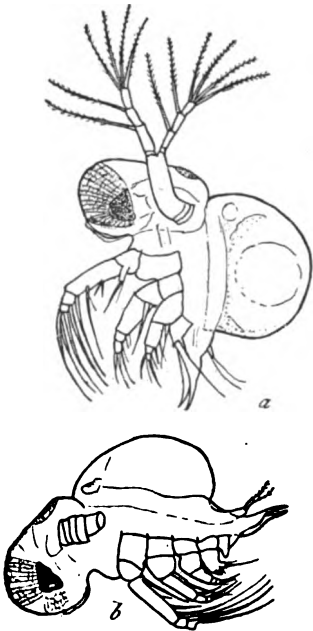


FIG. 19.—PODON LEUCKARTI. *a*, SIDE VIEW OF FEMALE; *b*, SIDE VIEW OF MALE.

are broadly and evenly rounded dorso-posteriorly. The head has a nearly straight upper contour, about two-thirds as high as long, and nearly one-half the length of the entire body. A prominent convexity below and just posterior to the neck region. Both branches of the two branched antennæ (second antennæ) are armed with six setæ each, while both *P. intermedius* Lilljeborg, and *P. polyphemoides* (Leuckart) have seven setæ on one branch and six on the other one.

Outer process of the first leg with one seta; of second leg with one seta; of third leg with one seta; of fourth leg with two setæ.

The posterior part of the body terminates in two long spines. The shell is very transparent, and from grayish yellow to whitish in color. The so-called neck gland is situated near the neck invagination.

Remarks.—This species was noted in the same collections as those containing *Evadne nordmanni* Lovén, and therefore

with the same species of Copepoda.

Occurrence.—Surface tidal tows at Bureau of Fisheries wharf, Woods Hole, Massachusetts. Also in ordinary surface tows at 10 p. m., quiet water and northeast wind; more abundantly at 8 a. m. in sunlight at the same place, August 11, 1909.

Distribution.—North Sea (Timm), May-July; off western coast of Europe and the Mediterranean Sea (Lilljeborg).

Genus EVADNE Lovén, 1836.

EVADNE NORDMANNI Lovén.

Evadne nordmanni LOVÉN, Kongl. Sven. Vet. Akad. Handl., 1835, p. 1, pls. 1-2, figs. 1-16.—BAIRD, British Entomostraca, 1850, p. 114, pl. 17, fig. 2.—SARS, Forh. Vid. Selsk. Christiania, 1890, no. 1, p. 14.—LILLJEBORG, Nova Acta Regiæ Soc. Sci. Upsaliensis, ser. 4, vol. 19, 1901, p. 642, pl. 86, figs. 4-17.—APSTEIN, Nordisches Plankton, Cladocera, Kiel, 1901, p. 12, fig. 22.

Length of female from 0.90 to 1.15 mm. Height about one-half the length. Males slightly smaller, and tapering more rapidly posteriorly to a hyaline point.

Seen from the side (fig. 20*a*) the female is more or less triangular, depending upon the number of eggs in the brood sac. The body is somewhat rounded posteriorly, tapering to a small hyaline point. Head small, not separated from the brood sac by a distinct invagination, and about one-third the length of the rest of the body. The so-called neck gland is situated nearly over the eye spot. Eye spot as usual, large, somewhat triangular, and with many large crystalline lenses.

The brood sac may contain from three to eight embryos, thus causing its outline to be quite variable. Shell plain, quite transparent, and with no especial markings. Grayish white to yellowish in color.

Remarks.—Collected in company with *Podon leuckarti*, *Temora longicornis*, *Pontella meadii*, *Acartia tonsa*, *Centropages hamatus*, and *Labidocera æstiva*.

Occurrence.—Surface tows from Bureau of Fisheries wharf, Woods Hole, Massachusetts, June to November.

Distribution.—North Sea, April to August (Timm); Atlantic Ocean (Hansen); North Atlantic (Lilljeborg); Narragansett Bay (Williams); Norwegian Plankton (Apstein).

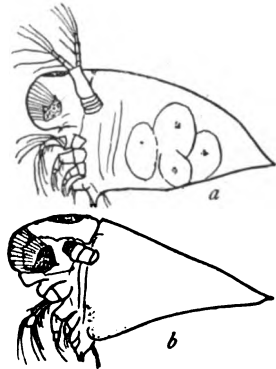


FIG. 20.—EVADNE NORDMANNI. *a*, SIDE VIEW OF FEMALE; *b*, SIDE VIEW OF MALE.

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NEW ARENACEOUS FORAMINIFERA FROM THE PHILIPPINES.

By JOSEPH AUGUSTINE CUSHMAN,
Of the Boston Society of Natural History.

The following genus and ten species belonging to the arenaceous group of the Foraminifera are believed to be new. They were obtained, among numerous other species, by the Bureau of Fisheries steamer *Albatross* in the Philippine expedition of 1907-1910. The species usually have been frequent or even abundant at the station where they were found and in some cases seem to have a general distribution in many parts of the archipelago. Except for fig. 7, the figures are from photographs taken at the U. S. National Museum.

SAGENINA DIVARICANS, new species.

Description.—Test attached, tubular, very slender, uniform in size, branching at nearly regular intervals with a wide angle, sometimes anastomosing; walls of coralline mud, somewhat roughened; apertures at the ends of the tubes; color, white.

Diameter of the tubes 0.05 to 0.1 mm.

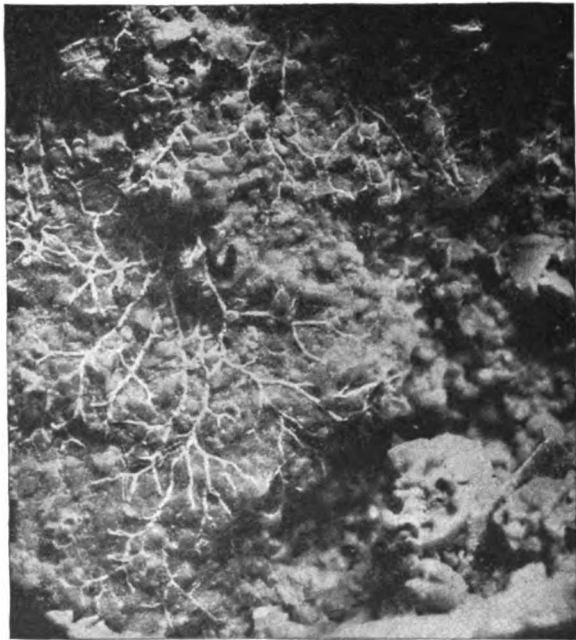


FIG. 1.—*SAGENINA DIVARICANS*. $\times 10$. FROM PHOTOGRAPH.

Type-specimen.—Cat. No. 8229, U.S.N.M., from *Albatross* station 5145, vicinity of Jolo, Jolo Archipelago, 23 fathoms; attached to hardened coral sand on the interior of a bivalve shell.

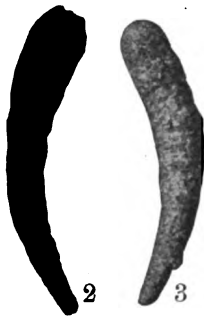
REOPHAX PSEUDOBACILLARIS, new species.

Description.—Test elongate, arcuate, composed of a linear series of chambers; chambers shorter than broad in surface view, except the one last formed, which appears nearly spherical, numerous, sixteen to twenty or more; wall arenaceous, fairly coarse for the size of the test, slightly rough on the exterior; aperture small, in the middle of the terminal face of the chamber; color, dark reddish brown.

Length up to 2 mm.

Type-specimen.—Cat. No. 8226, U.S.N.M., from *Albatross* station 5236, off the eastern coast of Mindanao, Philippines; 494 fathoms.

FIGS. 2, 3.—*REOPHAX PSEUDOBACILLARIS*. X 20. FROM PHOTOGRAPH.



This species, while it has somewhat the appearance of *R. bacillaris* H. B. Brady, is much smaller, more arcuate, and has a dark reddish brown color.

REOPHAX SPICULOTESTUS, new species.

Description.—Test of medium size, composed of a linear series of elongate chambers, oval, in a straight or more often slightly curved line, contracted at the ends of each chamber, increasing rapidly in size toward the apertural end; perfect adult specimens with six or more chambers; wall thin, composed largely of siliceous sponge spicules, for the most part laid lengthwise of the test and firmly cemented; some sand grains present, usually neatly cemented; aperture fairly large; color, grayish.

Length up to 2 mm.

Type-specimen.—Cat. No. 8227, U.S.N.M., from *Albatross* station 5236, off the eastern coast of Mindanao; 494 fathoms.

This differs much in form and size from *R. spiculifer* H. B. Brady, as well as in the very different appearance of the test. Occurring as it does in company with an abundance of arenaceous species, it shows its selective power in the composition of its test.



FIG 4.—*REOPHAX SPICULOTESTUS*. X 20. FROM PHOTOGRAPH.

HORMOSINA OVALIFORMIS, new species.

Description.—Test composed of a straight or slightly curved series of chambers closely joined to one another; chambers evenly tapering at either end, or slightly oval; aperture small, rounded; walls of fine

sand and a brownish cement, slightly roughened on the outside; color, yellowish brown, white about the aperture.

Length up to 2.5 mm.

Type-specimen.—Cat. No. 8221, U.S.N.M., from *Albatross* station 5236, off the eastern coast of Mindanao; 494 fathoms.

This differs from other species of the genus in its oval, closely connected chambers, in its small aperture, and rather pointed apertural end.

HORMOSINA ELONGATA, new species.

Description.—Test elongate, nearly straight, composed of a series of elongate chambers; largest diameter near the base of each chamber, thence gradually narrowing toward the apertural end; wall rather thick, composed of fine material with much cement, smoothly finished; aperture rather small, elliptical; color, reddish brown, lighter about the aperture.

Length 5 to 10 mm.

Type-specimen.—Cat. No. 8263, U.S.N.M., from *Albatross* station 5236, off the eastern coast of Mindanao; 494 fathoms.

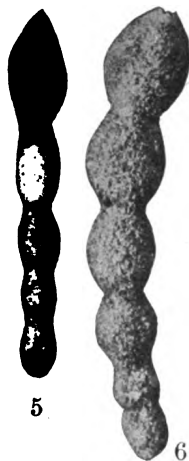
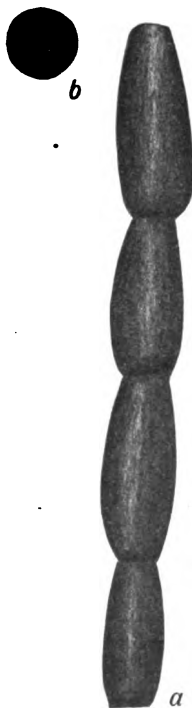
This species is much more elongate in regard to its entirety and in its individual chambers than other species of the genus. Its nearest related species seems to be *Hormosina carpenteri* H. B. Brady, but the curvature of the test and the shape of the chambers is very different.

SPHÆRAMMINA, new genus.

Description.—Test composed of a series of chambers, the one last formed completely enveloping the preceding ones, but the axis straight; wall arenaceous.

Type of the genus.—*Sphærammina ovalis*, new species.

FIG. 7.—*HORMOSINA ELONGATA*. $\times 15$. a, SIDE VIEW; b, APERTURAL VIEW.



FIGS. 5, 6.—*HORMOSINA OVALIFORMIS*. $\times 15$. FROM PHOTOGRAPH.

This genus strongly reminds one of *Ellipsoidina*, but there is an arenaceous wall, and the connections between the apertural ends of the chambers are indistinct or wanting. With its straight axis it belongs to the Reophacinæ and holds a relation to *Reophax* and *Hormosina* similar to that which *Glandulina* holds to *Nodosaria*.

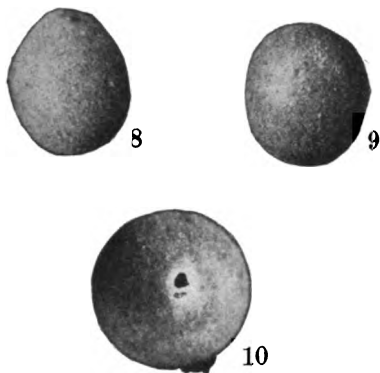
SPHERAMMINA OVALIS, new species.

Description.—Test oval or spherical, composed of a series of chambers, with a straight axis, each chamber as added extending back and enveloping the preceding; chambers oval or nearly spherical; wall of fine sand firmly cemented; aperture elliptical or rounded; color, grayish or yellowish brown.

Diameter 1 to 2 mm.

Type-specimen.—Cat. No. 8223, U.S.N.M., from *Albatross* station 5236, off the eastern coast of Mindanao; 494 fathoms.

This species in many ways resembles the Miocene *Ellipsoidina ellipsoides*. The characters of the wall are similar to those of *Hormosina*.



FIGS. 8-10.—*SPHERAMMINA OVALIS*. $\times 15$. FROM PHOTOGRAPH. FIGS. 8 AND 9, SIDE VIEW; FIG. 10, APERTURAL VIEW.

HAPLOPHRAGMOIDES GRANDIFORMIS, new species.

Description.—Test free, involute, planospiral; chambers low and broad, seven to nine in the last-formed coil, inflated; peripheral line of the test in side view considerably depressed at the sutures; wall composed of

rather coarse sand grains with a considerable proportion of yellowish-brown cement, somewhat rough on the exterior; aperture an elongate, curved slit at the base of the apertural face of the chamber; color, light brown.

Diameter, about 3 mm.

Type-specimen.—Cat. No. 8217, U.S.N.M., from *Albatross* station 5152, near the Tawi Tawi group; 34 fathoms.

This is a large species somewhat resembling *H. canariense*, but involute with broad low chambers.

AMMOBACULITES REOPHACIFORMIS, new species.

Description.—Test free, elongate-fusiform; early portion consisting of chambers arranged in a close-coiled planospiral series, much compressed, later portion straight, *Reophax*-like, consisting of a linear series of chambers progressively increasing in size; wall coarsely arenaceous, rough, fairly thick;

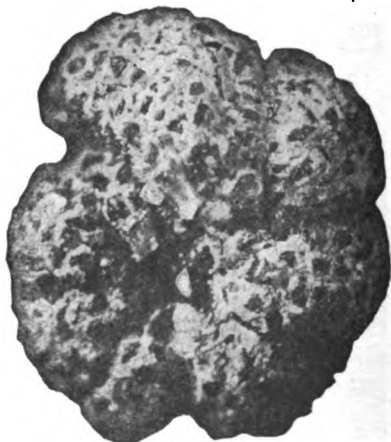


FIG. 11.—*HAPLOPHRAGMOIDES GRANDIFORMIS* $\times 25$. FROM PHOTOGRAPH.

aperture circular, in the middle of the terminal face, often on a projecting, neck-like portion; color variable, usually white or gray.

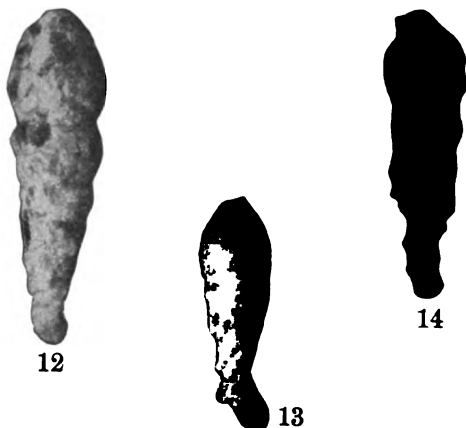
Length, up to 3.5 mm., diameter, 0.4 to 1.0 mm.

Type-specimen.—Cat. No. 8207, U.S.N.M., from *Albatross* station 5156.

This is typically a shallow-water coral reef species, and has been found abundantly in the Philippine material from such stations, between 16 and 78 fathoms.

The early coiled portion separates it from *Reophax*, but the later portion alone would be described as belonging to that genus. At first I took it to be the microspheric form of some species of *Reophax*, but it is very abundant and when perfect seems always to have the coiled early development.

Reophax scorpiurus, which it in some ways resembles, is a common species in the same locality, but in the material examined was not seen to have a true close-coiled young in any case, although the young portion is often curved.



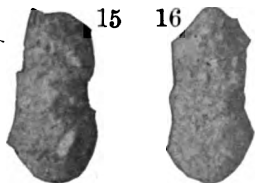
FIGS. 12-14.—*AMMOBACULITES REOPHACIFORMIS*. $\times 25$. FROM PHOTOGRAPH.

***AMMOBACULITES CYLINDRICUS*, new species.**

Haplophragmium calcareum (part), H. B. BRADY, Rep. Voy. *Challenger*, Zoology, vol. 9, 1884, pl. 23, fig. 6.

H. agglutinans FLINT, Rep. U. S. Nat. Mus., 1897 (1899), p. 275, pl. 19, fig. 2 (not *Spirolina agglutinans* d'Orbigny).

Description.—Test free, elongate, cylindrical; early chambers planospiral, completely involute, with five to six chambers in each volution; later portion uncoiled, cylindrical, made up of a linear series of chambers; wall coarsely arenaceous, but the surface rather smoothly finished; aperture in the middle of the terminal face in the uncoiled portion simple; color, gray.



FIGS. 15, 16.—*AMMOBACULITES CYLINDRICUS*. $\times 20$. FROM PHOTOGRAPH.

Length, 2 mm., diameter, 0.5 to 0.75 mm.

Type-specimen.—Cat. No. 8205, U.S.N.M., from *Albatross* station 5201.

This species differs from the ordinary form of *A. calcareus* in its cylindrical shape and from *A. agglutinans* in the greater proportion of coiled chambers, which are completely involute.

AMMOSPHAEROIDINA GRANDIS, new species.

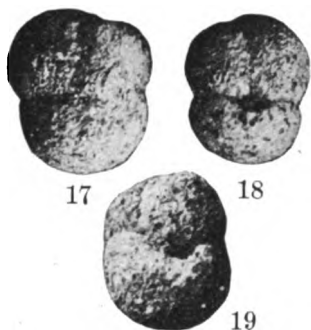
Description.—Test large, globular, in adults usually made up of three visible chambers, one large one and two smaller ones on the opposite side; wall coarsely arenaceous, but with a fairly smooth exterior; aperture at the base of the largest chamber crescentic or semicircular, nearly opposite the suture marking the juncture of the walls of the two smaller chambers; color, grayish-brown.

Diameter, up to 3 mm.

Type-specimen.—Cat. No. 8209, U.S.N.M., from *Albatross* station 5236, off the eastern coast of Mindanao; 494 fathoms.

FIGS. 17-19.—AMMOSPHAEROIDINA GRANDIS. $\times 8$. FROM PHOTOGRAPH. FIGURES AT UPPER RIGHT AND BELOW ARE APERTURAL VIEWS.

This species differs from the allied *A. sphaeroidiniformis* (H. B. Brady) in its much larger size, more regular form, and smooth surface. It was abundant at the above station.



THE DERMAPTERA (EARWIGS) OF THE UNITED STATES NATIONAL MUSEUM.

By MALCOLM BURR,

Fellow of the Entomological, Zoological, and Linnean Societies of London.

The opportunity of examining the collection of Dermaptera (Earwigs) in the United States National Museum has been a very great privilege to me. It has enabled me to see the types of many of the American species at a time when an examination of most of the types of the European collections has been fresh in my memory. In several instances I have actually been able to compare the types of Caudell and Rehn with those of older European authors. Consequently I have been able to correlate the work done in recent years in America with that done by European authors. When we remember that of all the types of earwigs in existence, with the exception of those of Scudder, Caudell, and Rehn, are preserved in European collections, the importance of this opportunity will be realized.

The Dermaptera are not an easy group, and the difficulty is increased by the fact that no satisfactory general comprehensive account based upon a thorough examination of original specimens has yet been published; for de Bormans' Monograph has numerous imperfections, and is already long since out of date. So few species have been well illustrated that it is of the utmost importance that authentic collections be compared. It is the remoteness of the museums of England, Paris, Vienna, Berlin, etc., that is responsible for such errors as have crept into the work of the American authors. Knowing only too well the difficulties in dealing with such a group, when our total knowledge is so imperfect, the classification in a state of flux, and the material available relatively so small, I can not suppress my surprise that the work of the American authors is so good.

Several years of friendly correspondence with Prof. Lawrence Bruner and Messrs. Scudder, Rehn, and Caudell has thus been crowned with an actual examination of the material on which they worked, so that the friendship grown up in spite of the intervening seas has been carried to its logical conclusion.

I hope that this account of an European entomologist's examination of American material may be of real use in correlating the labors of the workers in the Old and New Worlds.

My sincere thanks are due the officers of the United States National Museum for so kindly admitting me to an examination of this material at my own convenience, and to my friend, Mr. A. N. Caudell, for his unwearied assistance and courtesy.

Subfamily APACHYIDÆ.

Genus APACHYUS Serville.

1. *DEPRESSUS* Paillet de Beauvois.

Africa.—Liberia, Mount Coffee, March, 1897, two females (R. P. Currie). "More in spirits."

Both these are the true *A. depressus*, with pale elytra.

Family PYGIDICRANIDÆ.

Subfamily DIPLATYINÆ.

Genus DIPLATYS Serville.

1. *JANSONI* Kirby.

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, March 26 and 31, 1907 (Schwarz and Barber). [The original two females quoted by Caudell, 1907², p. 170.]

2. *SEVERA* Bormans.

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, April 13 to 21, 1906, male and female (Schwarz and Barber). [Caudell, 1907², p. 169.]

Subfamily KARSCHIELLINÆ.

Genus KARSCHIELLA Verhoeff

1. *CAMERUNENSIS* Verhoeff.

Congo.—Luebo (Dr. W. Snyder).

The specimen is recorded by Rehn [1905¹, p. 504] as *Bormansia meridionalis* Burr. The specimen is not mature, but it is more probably referable to *K. camerunensis* or else to *K. neavei* Burr, both of which are West African forms. *B. meridionalis* is recorded from Transvaal.

Subfamily PYGIDICRANINÆ.

Genus PYGIDICRANA Serville.

1. *V. NIGRUM* Serville.

Brazil.—Bonito Province, Pernambuco, January 17, 1883 (Koebele). One female and one broken specimen.

Family LABIDURIDÆ.

Subfamily ALLOSTETHINÆ.

Genus ALLOSTETHUS Verhoeff.

1. *INDICUM* (Hagenbach).

Lower Siam.—Khow Sai Dow, Trong. 1,000 feet elevation. January-February, 1899 (W. L. Abbott). (Cat. No. 8167.)

This is the type of *Labidurodes magnificus* Rehn [1905¹, p. 504, fig. 3], which must accordingly fall as a synonym.

Subfamily PYRAGRINÆ.

Genus PYRAGRA Serville.

1. FUSCATA Serville.

Costa Rica.—San Carlos (Schild-Burgdorf). Fragment. [See Rehn, 1903², p. 299.]

British Honduras.—Bengue Viejo, July, 1904 (W. A. Stanton).

I also refer here, with a little hesitation, Rehn's type of *Echinopsalis brevibractea* [1903², p. 300], taken by G. H. Osborn in Mexico, Motzorong, Veracruz, January, 1892. (Cat. No. 7078.) The specimen is immature, and consequently the specific characters are not properly developed. But it has a superficial appearance of this species or else of the *P. dohrni*.

P. fuscata is recorded from Mexico by de Bormans, Dohrn, and Burr.

I agree with Rehn in restoring Serville's name for this species.

2. DOHRNI Scudder.

Peru.—Piches and Perene valleys, 2,000 to 3,000 feet. (Cat. No. 8171.)

This is Rehn's type of *Pygidicrana peruviana* [1905¹, p. 501], a female, so that name consequently falls as a synonym.

3. BUSCKI Caudell.

Cuba.—Baracoa, October 14, 1901 (Busck), one male. Type of Caudell [1907¹, p. 166]. (Cat. No. 10288.)

Jamaica.—"In rotten palm," March 18, 1907 (W. Johnston).

This is a good species; it is related to *P. paraguayensis* Borelli and *P. brunnea* Burr, differing from both in the nearly glabrous body and absence of keels on the upper surface of the last dorsal segment.

This group differs from that of *P. fuscata* in the transverse pronotum.

ARTHROEDETUS BARBERI Caudell.

Guatemala.—Polochic River (H. S. Barber). (Cat. No. 10366.) Type of Caudell [1907², p. 171].

The apparently anomalous features of this creature are due to the immaturity of the specimen; the very long third antennal segment is a well-known characteristic of nymphs and larvæ; Terry (1905) has shown that the apical segments all grow out of the third, which is consequently extra long in immature specimens. The features of the thorax are explainable in the same way.

It is impossible to say to what species it should be referred; very likely to *Pyragra fuscata* Serville, or some ally.

Genus ECHINOPSALIS Bormans.

1. GUTTATA Bormans.

Paraiso, Canal Zone (P. B. Preston).

A single female, with the abdomen broken off and cemented on again upside down.

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, April 23 (Barber). This larva seems to be referable here. It is quoted by Caudell as *Psalis*, species [1907², p. 172].

Subfamily ECHINOSOMATINÆ.

Genus ECHINOSOMA Serville.

1. WAHLBERGI Dohrn

Africa.—Liberia, Mount Coffee (R. P. Currie), one female.

Subfamily PSALINÆ.

Genus PSALIS Serville.

1. PULCHRA Rehn.

Nicaragua.—1873, one male. "Accession 13755."

Trinidad.—One male (Busck). Caudell's specimen [1907¹, p. 167].

Caudell [1907¹, p. 167], tells us that *Labia pictipennis* of Bruner (1906) is a synonym. It is very close to *P. rosenbergi* Burr. The color, especially of the latter, is so variable that I can only find the hairy body and blunter angles at the sides of the sixth to the ninth abdominal segments of the male to distinguish the latter. *P. pulchra* is probably identical with *P. percheron* Guérin.

2. AMERICANA Paliot de Beauvois.

Colombia.—Bogotá, one broken specimen.

Santo Domingo.—San Francisco Mountains, September, 1905 (Busck), two females (see Caudell, 1907¹) with the spot of the elytra ill-defined, ochre yellow in color.

Cuba.—Cayamas (Schwarz).

Immature specimens of most or all species of this genus may be, and probably often are, confused with *Anisolabis*, as Rehn rightly suggests [1903², p. 301].

3. GAGATINA Klug.

Porto Rico.—Utuado, January, 1899 (Busck), and El Yunque (Dr. C. W. Richmond).

Santo Domingo.—San Francisco Mountains, September, 1905 (Busck). [Caudell, 1907¹, p. 170.]

These are the specimens recorded by Rehn as *Apterygida buscki* [1903⁴, p. 129; type!] and by Caudell as *Sphingolabis buscki* [1907, p. 170]. They only differ in their smaller size and slenderer build from Peruvian and Ecuadorian specimens of *Psalis colombiana* Bormans, which is identical with *Carcinophora robusta* Scudder, which, in my opinion, is indistinguishable from *Psalis gagatina* of Burmeister, a species about which no one has felt certain hitherto. I consider that the genus *Carcinophora* coincides with *Psalis*, as the only character, absence of wings, is valueless. *A. buscki* would then be an insular, somewhat stunted, race. The finest specimens known are those recorded by Borelli from Costa Rica; some of these have a small yellowish spot near the lateral margin of the elytra; this repre-

sents the transition to *P. americana*. The specimen figured by de Bormans [1903, pl. 1, fig. 5] has spotted elytra, and is probably referable to *P. americana* or *P. pulchra*.

4. *CINCTICOLLIS* Gerstæcker.

Africa.—Liberia, Mount Coffee, three males and one female (R. P. Currie).

I have recently shown [1909⁵, p. 113] that *Brachylabis cincticollis* of Gerstæcker is the nymph of *Psalis picina* Kirby, so the true name of this species is *Psalis cincticollis* (Gerstæcker).

5. *NIGRA* Caudell.

Trinidad.—Montserrat, July 4, 1905; a single female taken by Busck. (Cat. No. 10290.) Caudell's type (1907¹), p. 167.

It is unfortunate that the male is unknown. The almost square pronotum, rounded posteriorly, and the short, thick antennal segments are the most distinctive features.

It appears to be allied to *P. gagatina* Bormans and the African *P. cincticollis* Gerstæcker.

Genus *ANISOLABIS* Fieber.

1. *ANNULIPES* Lucas.

Mexico.—One female.

Mexico.—Minatilan, February 1, 1902 (H. Osborn), one female. [See Rehn, 1903², p. 304.]

Mexico.—(Duges), two females. One specimen is determined by Rehn as *A. antoni* Dohrn, but I consider that species identical with *A. annulipes* Lucas. [See Rehn, 1903², p. 305.]

Paraguay.—Sapucay (W. F. Foster). Caudell's originals of *A. azteca* [1904, p. 180], which I also consider synonymous with *A. annulipes*, as has been suggested by Rehn [1906, p. 109].^a

Hawaii.—Honolulu, three males, five larvæ (Kotinsky).

California.—(C. V. Riley), one female.

Algeria.—"On a date palm;" labeled "*An. mauritanica* Lucas, I believe."

Guatemala.—Chiantla, one female.

Cuba.—Baracoa, one male, September (Busck). [Caudell, 1907¹, p. 168.]

Porto Rico.—Fajardo (Busck). A fine female. [See Rehn, 1903², p. 129.]

Florida.—Crescent City (C. V. Riley), one male. "New Orleans, La" (Shufeld) (C. V. Riley), one female.

Guadeloupe.—*A. bormansi*, Scudder's type; female, Guadeloupe, undoubtedly referable here; agrees with Caudell and Rehn.

^a I have since seen Dohrn's types of *A. azteca*; it is a good species, probably a *Gonolabis*: the so-called *A. azteca* of literature are, however, probably all referable to *A. annulipes*: Dohrn's type of *A. antoni* is certainly indistinguishable from *A. annulipes*.

Arizona.—Yuma, August 16, 1902 (Brown), one female.

Trinidad.—(Busck), one female. "*A. antoni*." [Caudell, 1907¹, p. 168.]

2. *XENIA* Kirby.

Hawaii.—(Henshaw), one male, determined as *A. maritima*.

Hawaii.—Tantalas, one male (Kotinsky); also determined as *A. maritima*.

This is a little known species. In the brown head and pronotum it approaches *A. littorea*, but the excavate forceps are distinctive.

3. *PLUTO* Rehn.

Liberia.—Mount Coffee (O. F. Cook). Cat. No. 8165. Rehn's type. [See Rehn, 1905¹, p. 506, fig. 4.]

Being a female, it is impossible to define its true affinities; perhaps it is the female of *A. rufescens* Kirby.^a

4. *MARITIMA* Bonell.

Canary Islands.—Teneriffe, Bayamas, two females. (I am inclined to think that one of these is a female of *A. maxima* Brullé.)

New Zealand.—One female and a larva (Koebele).

Santo Domingo.—San Francisco Mountains, one female.

Porto Rico.—Bayamon, January, 1899, two males (Busck). One is unusually small. [See Rehn, 1903⁴, p. 129.]

Japan.—Two males and one female.

5. *MARGINALIS* Dohrn.

Japan.—Two males and one female.

These appear to be the true *A. marginalis* of Dohrn, but the sculpture of the abdomen is not very well marked.

Genus *BORELLIA* (Burr).^b

1. ——— Species.

Nicaragua.—"Accession No. 26695."

This specimen is incomplete; it is a large species, perhaps related to *B. peruviana* Bormans, but not so intensely black as that species.

2. *JANEIRENSIS* Dohrn.

Porto Rico.—Utado, January, 1899 (Busck), [Caudell, 1907¹, p. 168], one female.

Jamaica.—"In rotten palm." March 19, 1907 (J. R. Johnston), No. 22, one female.

3. *MINUTA* Caudell.

Porto Rico.—Mayaguez, one female (Busck). [Syntype of Caudell, 1907¹, p. 168.]

^aI have since seen the type of Dohrn's *A. angulifera*; it is the male corresponding to *A. pluto*. I am not yet prepared to discriminate satisfactorily between this species and *A. annulipes*.

^bThis name is preoccupied by *Borellia* Rehn, Proc. U. S. Nat. Mus., vol. 30, 1906, p. 379, so a new name is required. I propose *Euborellia*.

This species seems indistinguishable from the Oriental *B. stålî* of Dohrn, of which it is probably an introduced specimen. The one examined is a little broader than the usual *B. stålî* and less intensely black in color.

Subfamily LABIDURINÆ.

Genus LABIDURA (Leach).

1. *RIPARIA* Palisot de Beauvois.

British Honduras.—Bengue Viejo (W. A. Stanton), one female, 1906. This dark specimen is labeled "*Forficula smithi* female?," and also "*Psalis*."

Mexico.—Oaxaca, Rio Antonio, one female (F. Knab); "Mat XI," one female. (Accession No. 20097.)

Mexico.—Cordoba, one male, April 24, 1908 (F. Knab).

Japan.—Three males.

England.—Hants Christchurch, August, 1904, male and female (W. J. Lucas), one female (C. V. Riley). "*Gigas* of Eur."

Africa.—Kongo Free State, "39," one male. Luebo, one female and one larva (Dr. W. Snyder), see Rehn [1905¹, p. 502].

Porto Rico.—Fajardo, February, 1899, one female (Busck) [see Rehn, 1903⁴, p. 129], one male and three larvæ.

Bermuda.—"Accession No. 17400." Three determined as *L. bidens* by Rehn, who provisionally follows Kirby's arrangement of this species or group of species.

Java.—Buitenzorg, one dark female, April-December, 1897 (Fairchild).

China.—Pekin, Chilli, April, 1901, Cat. No. 8164. Rehn's type of *Labidura mongolica* [1905¹, p. 503]. It is a male, and not specifically distinct from typical *L. riparia*, though a fine large form. This species darkens rapidly after death.

Cuba.—Cabanas (Palmer and Riley), "*L. bidens*."

2. *LIVIDIPE* Dufour.

Philippines.—Bay Laguna (P. Stangl). Several specimens of both sexes (four males, three females). Bacor, one male, three females (P. Stangl). Balinag, male (A. P. Ashby).

Subfamily BRACHYLABINÆ.

Genus LEPTISOLABIS Verhoeff.

1. *HOWARDI*, new species.

Staura minore, gracili; colore atro, antennis pedibusque pallescentibus, corpus totum confertim punctulatum; oculi magni, marginem posticum capitis fere attingentes; pronotum elongatum et postice ampliatum, margine antico in collem productum; forcipis brachia maris cylindrica, basi haud contigua, sensim arcuata.

Male.—Length of body 8 mm.; length of forceps 1.75 mm. Size small and slender.

Color jet black, dull. The whole body clothed with long golden pubescence. The whole surface finely punctulate.

Antennæ with thirteen segments, brownish gray, all the segments very thick, third scarcely longer than broad, fourth really broader than long; fifth globular, the rest gradually lengthening and also thickening.

Head tumid, hinder margin straight, sides convex, and in front triangular; the small marks on the frons indistinct. The punctulations are exceedingly fine.

The eyes are very large and prominent, ovate in shape, and extend from the insertion of the antenna almost to the posterior margin of the head, gently converging posteriorly.

Pronotum about one and one-half times as long as the average breadth, all margins straight, sides gently diverging as the pronotum widens somewhat posteriorly. The anterior margin has the middle portion produced slightly, and carries a short but distinct cylindrical neck, so that the head is distinctly separated from the pronotum. Mesonotum transverse, posterior margin truncate; sides not keeled, but raised with blunt, tumid ridges converging posteriorly. Metanotum strongly concave posteriorly, almost entirely covering the first abdominal segment.

The whole of the thoracic plates are dull black and densely and finely punctulate.

The prosternum is twice as long as wide, parallel.

Mesosternum and metasternum somewhat broader than long, the posterior margin truncate; sternal plates reddish black and densely and finely punctulate.

Legs typical, femora slender, black, yellow at the base and apex, long and slender.

Tibiæ long and slender, yellowish.

Tarsi yellowish, long and slender. The second segment elongate and cylindrical, nearly as long as the third; the first is longer than the second and third combined.

Abdomen typical, of the same color and sculpture as the rest of the body, passing to reddish beneath; lateral tubercles on third and fourth segments faint. Last dorsal segment very short and transverse, but narrower than the abdomen; posterior margin narrowed, and concave in the middle, leaving a short triangular lobe on each side projecting slightly over the forceps.

Penultimate ventral segment short and broad, very obtusely rounded.

Pygidium short, very narrow, and compressed.

Forceps with the branches remote at the base, cylindrical, tapering, straight at first, gently arcuate toward the apex.

Guatemala.—Provincia de Alta Vera Paz, Trece Aguas, Cacao, April 19 (Schwarz and Barber). (In U. S. National Museum.)

Type.—Cat. No. 13087, U.S.N.M.

Named in honor of Dr. L. O. Howard, of the Department of Agriculture.

This is the original specimen recorded by Caudell from Guatemala [1907, p. 172] as *B. nigra*. Owing to the distance from Peru, I was not surprised to find that this specimen is distinct. The true *B. nigra* is a *Ctenisolabis* with a keeled mesonotum; this specimen, having no sharp keel on the mesonotum, is a *Leptisolabis*. I have not been able to compare it with the types of Verhœff's African species, but a Neotropical and an Ethiopian species of scarce archaic, apterous earwigs are not likely to be confused.

All the *Brachylabinæ* have a strong family likeness; at first glance, *L. howardi* looks like *B. nigra*, but the non-keeled mesonotum distinguishes it at once; the fourth to sixth antennal segments are shorter and the pronotum longer. It is more difficult to separate from *L. punctata*, from Java, but it is smaller and slenderer, the sculpture is finer, and the antennal segments shorter.

Probably some other species are confused in collections under the name of "*Brachylabis nigra*."

Family LABIIDÆ.

Subfamily NESOGASTRINÆ.

Genus NESOGASTER Verhœff.

1. RUFICEPS Erichson.

Australia.—One nymph (Kæbele).

Subfamily LABIINÆ.

Genus LABIA Leach.

1. SILVESTRII Borelli.

Paraguay.—Puerto Bertoni. (Cat. No. 8303.)

This specimen, a female, is a syntype of Borelli, sent from Turin to be compared with the type of *L. paraguayensis* Caudell. It approaches that species in the form of the pronotum and antennæ, but the segments of the latter are rather strongly pyriform than conical; the abdomen also is parallel and not dilated. The forceps and pygidium are also somewhat different in both sexes.

2. UNIDENTATA Palisot de Beauvois.

This species was originally described by Palisot de Beauvois from Santo Domingo; Bolivar has since applied the name to specimens from Cuba. *Labia burgessi* Scudder, from Texas, appears to me to be the same thing, with abbreviated wings. Experience has shown over and over again that the abbreviation of the wings is a very common condition among earwigs, and is absolutely valueless as a specific character, although it somewhat alters the superficial appearance of the specimens. Now, I consider that the various specimens examined by me, from Cuba, Florida, Texas, Santo Domingo, Georgia, and St. Vincent, are all one and the same species, offering certain variation within determined limits, as is frequently the case

in other earwigs. This variation consists, in addition to the abbreviation of the wings already referred to, of the strength of the teeth of the male forceps, intensity of coloration from light reddish brown to blackish castaneous, and size. As *L. unidentata* is the earliest name which seems applicable to the species, I accept it and sink as synonymous also the following names: *L. guttata* Scudder, *L. melancholica* Scudder, and *L. pulchella* Serville. None of the descriptions show any valid specific characters for discriminating these species, and as the burden of proof lies with the describer, they may be safely, until such time as some further author, with ample material and a complete familiarity of the group, shall prove them to be distinct.

L. pulchella Serville [1839, p. 42], from New York, is fully winged; so is *L. guttata* Scudder [1876³, p. 265], from Texas; it is true Scudder compares his type with *L. pulchella*, but he does not succeed, in my opinion, in making a good case. It should be possible to find in the northeastern States specimens agreeing with Scudder's description of *L. guttata* from Texas.

L. melancholica Scudder [1876³, p. 267], also from Texas, is also a winged form, but the wings have no yellow spots; the male, moreover, is unknown. It is described as a "slender, graceful, and very dark-colored species, related to *L. burgessi*." I possess a dark female from Santo Domingo which agrees with this description. I look upon *L. melancholica* merely as a dark-winged form.

L. burgessi Scudder [1876³, p. 266], described from Florida, is a wingless form, and consequently the appearance is altered; but, structurally, syntypes of Scudder in my collection are not specifically different from Bolivar's specimen of *L. unidentata* from Cuba, nor from specimens from Trinidad, in the U. S. National Museum, determined by Caudell as *L. brunnea*. I possess specimens from Thomasville, Georgia, which are structurally indistinguishable from *L. burgessi*, but much darker in color.

To recapitulate, all the brown nearctic *Labias* should, in my opinion, be regarded as a single variable species; to it we give the oldest applicable name *L. unidentata* Palisot de Beauvois, and sink as synonymous the following: *L. pulchella* Serville [1839, p. 42]; *L. guttata* Scudder [1876³, p. 265]; *L. burgessi* Scudder [1876³, p. 266]; and *L. melancholica* Scudder [1876³, p. 267].

United States.—Florida. (*L. burgessi*) "agrees with a female type in Scudd. coll. A. N. Caudell." North Carolina, Dept. Agric. Entom. Cat. No. 420, "collected and donated by W. F. Fiske." [Caudell, 1901¹, p. 168.] (*L. burgessi*, female.)

Porto Rico.—Aguadilla, "*A. gravidula*" and one female.

Jamaica.—Male, labeled "*L. arachidis*."

Trinidad.—San Francisco Mountains, four males and three females. (*L. pulchella*.)

Cuba.—Cayamas, female (Schwarz). (*L. pulchella*.)

Mexico.—Orizaba, January 9 to 16, 1902 (H. Osborn). Determined by Rehn. One female.

Rehn [1903², p. 305] doubtfully refers this specimen to *L. guttata* Scudder as not quite agreeing with Scudder's description. It is a female, in not very good condition. I prefer to regard it, with some doubt, as a female of *L. unidentata*.

3. *BILINEATA* Scudder.

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, one male (Barber). [See Caudell, 1907², p. 173.]

4. *ARACHIDIS* Yersin.

"From a ship at San Francisco which arrived from India" (Cat. No. 6588), two males, labeled "*Carcinophora*, sp."

Mexico.—Cordoba, one female, April 26, 1908 (Knab).

Hawaii.—Honolulu, one female (M. van Dine). On label it is suggested that this specimen might be *S. hawaiiensis* Bormans, or *L. pygidiata* Bormans.

5. *ANNULATA* Fabricius.

Forficula annulata FABRICIUS, 1793, p. 4.

Labia annulata REHN.

? *Forficula dorsalis* BURMEISTER, 1838, p. 754.

Labia chalybea DOHRN, 1864, p. 429 (and authors).

Labia arcuata SCUDDER, 1876³, p. 257 (and authors).

Labia flaviscuta REHN, 1903², p. 305.

The above synonymy calls for some comments. I follow Rehn in restoring Fabricius' name, which is perfectly applicable to this species, as de Bormans had noticed (1900, p. 69), in his contention that the mass of doubtful names of older authors should be reduced as far as possible, and that an absolute proof of identity is not necessary where the evidence is fairly strong in favor if so doing, provided that there be no evidence to the contrary. Fabricius' species is recorded from "America meridionalis insulæ." This justifies our use of the name *L. annulata* Fabricius, in place of the more familiar *L. arcuata* Scudder.

Now as to *L. flaviscuta* Rehn. I consider it to be identical with the variety of *L. arcuata* having yellow pronotum, as mentioned by de Bormans (1893, p. 6, and 1900, p. 69). The shorter wings and somewhat longer pronotum of the female, quoted by Rehn to differentiate *L. flaviscuta*, are not, in my opinion, of sufficient value as discriminating characters.

Next, as to the identity of *L. arcuata* with *L. chalybea*. Two of Dohrn's original specimens of *L. chalybea* are in the Vienna Museum and both are from Venezuela; one, apparently a female, has the head and apex of the abdomen missing; it is dull brown in color and strongly pubescent. I can not distinguish it from females of *L. arcuata* Scudder.

The other specimen is also a female; its pygidium is narrow, bluntly conical, with two minute points at the apex. Moreover, the elytra, though bluish, are paler at the shoulders, and strongly pubescent.

Now although the typical *L. arcuata* of Scudder differs rather decidedly from what has always been regarded as *L. chalybea*, I have examined specimens from various localities, which fill in the gap, and in some cases both forms are taken together.

The typical *L. arcuata* form is rather large, broad, with more or less dilated abdomen, brownish color, strong pubescence, and strongly bowed forceps, often with a small tooth.

The typical *L. chalybea* is narrower, the abdomen not dilated, the elytra steel-blue, feebly or not at all pubescent, the forceps unarmed and gently arcuate.

It will be admitted by all that the curvature of the forceps, the intensity of coloration, and strength of the pubescence are unstable characters.

Accordingly, we turn to the pygidium to decide the question. Now, here I am compelled to admit that even the pygidium fails through instability of form.

I possess in my own collection two fine males of the undoubted *L. arcuata* form, both taken by Mr. W. F. H. Rosenberg at an elevation of about 1,000 feet, at Chimbo, in Ecuador, in August, 1897. In one the pygidium is very broad and swollen at each side into a blunt, thick tubercle; in another the pygidium is less broad, truncate, with a fine point at each corner. This is the pygidium that we associate with *L. chalybea*, but the general form and color of the body is decidedly that of *L. arcuata*.

I have seen both forms of pygidium also in specimens from Mexico. The small, steel-blue forms which are generally called *L. chalybea* have the two-point pygidium; the *L. arcuata* form has it as often as not. Therefore we can not distinguish the two by the forms of the pygidium of the male.

In Dohrn's original female in the Vienna Museum the pygidium is narrower, bluntly conical, with two minute points at the apex. Two of Caudell's females from Guatemala of the *L. chalybea* form, but labeled *L. arcuata*, have a broader, truncate pygidium, with a fine point at each corner.

Borelli's specimens of *L. chalybea* from Paraguay have the truncate two-point pygidium in the male, but the female has a simple conical pygidium.

If we regard *L. chalybea* as distinct from *L. annulata*, basing our separation on the form of the pygidium, we must disregard the other features of size, color, and pubescence. If we follow them, we must disregard the form of the pygidium.

In his description of *L. arcuata* Scudder refers to the pygidium of the male as "very broad, bifid, with large teeth." Dohrn does not refer to this organ in his description of *L. chalybea*.

In de Bormans' manuscript album, now in my possession, there are colored drawings of the male of each form and outline sketches of

the female. He makes no distinction whatever between the females of the two, and in the males the only distinction lies in the visible pygidium of *L. arcuata*, which it is retracted in *L. chalybea*; so we see that de Bormans had no clear idea of the separation of the two.

But an examination under the microscope of the pygidium of a number of specimens of both sexes from various localities shows that these apparently decisive distinctions in the shape of this organ are merely differences of degree. In some the points are finer than others, or longer, or shorter, sometimes almost obsolete.

When I look at one or two specimens, they seem so distinct that I wonder how I could ever confuse them. When I look at a longer series, I can not make up my mind where to draw the line.

Brunner also felt the uncertainty, for in his collection a number of specimens are placed with the undoubted *L. arcuata* form which are indistinguishable from some labeled *L. chalybea*.

Thus we are compelled to admit that a very uncertain line separates the typical *L. arcuata* form from the typical *chalybea* form. They pass insensibly from one to the other, just as the various races of *L. riparia*. I prefer to regard it as one species, under the name *Labia annulata* Fabricius, with three distinct forms, varieties, races, or subspecies, namely, *arcuata* Scudder, *flaviscuta* Rehn, and *chalybea* Dohrn.

Mexico.—Cordoba, one male (F. Knab); Orizaba, January 9 to 16, 1897 (H. Osborn). Rehn's type of *L. flaviscuta* [1903², p. 305].

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, two males (Schwarz and Barber). Caudell's originals (1907², p. 173) of *L. arcuata* and *L. chalybea*.

6. PARAGUAYENSIS Caudell.

Paraguay.—Sapucay, two males and two females (W. T. Foster), Cat. No. 8025. Types and syntypes of Caudell [1904, p. 181].

This is a good species, falling into the same group as *L. arachidis* Yersin, and *L. silvestrii* Borelli, characterized by the pyriform or clavate segments of the antennæ. (fig. 1.)

7. MÆKLINI Dohrn.

Santo Domingo.—San Francisco Mountains, one female (Busck) A remarkable pale thin female, apparently new.

This single female resembles specimens in my own collection which were determined by de Bormans as *L. mæklini*; but is somewhat

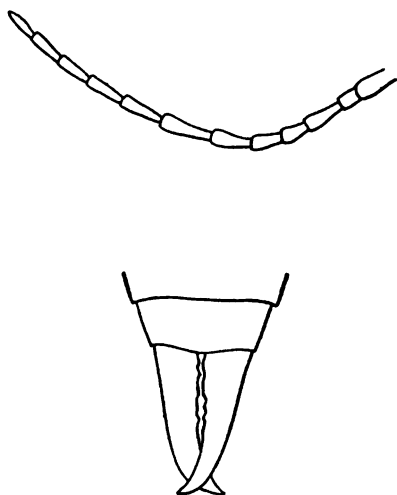


FIG. 1.—ANTENNA AND FORCEPS OF LABIA PARAGUAYENSIS.

narrower and the coloration differs a good deal in detail, though agreeing broadly. Upon color I place no reliance.

8. *MEXICANA* Bormans.

Dominica.—August (Busck).

This specimen agrees well with de Bormans type now in the Hof-Museum, Vienna. It does not seem to be a common species; it is well characterized by the long bifid pygidium of the male.

9. *BREVIORCEPS* Caudell.

Caudell's type [1907², p. 174] agrees with *L. luzonica* very closely; the pronotum seems a little wider posteriorly (in *luzonica* sides also rounded). The color is a little darker. It also resembles *L. mæklini*.

Further material is required before its true affinities can be determined.

10. *TRINITATIS* Bruner.

Trinidad.—June, one male and one female (Busck).

Dominica.—August, one female (Busck).

Cuba.—Cayamas, one male (Schwarz).

Caudell's original [1907¹, p. 169] seems allied with *L. chalybea*, but differs in the redder abdomen, smaller size, narrowed, truncate pygidium, and basally dilated forceps. The females I can hardly distinguish; those from Trinidad and Dominica really seem to be *L. chalybea*, but I refer them here, following Caudell, as they were taken together with the males.

11. *ROTUNDATA* Scudder.

Mexico.—Orizaba, January 9 to 16, 1902 (H. Osborn), one female [Rehn, 1905², p. 306], a bleached female.

Accession No. 20097, male and female.

12. *SCHWARZI* Caudell.

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, male and female.

This is Caudell's type [1907², p. 173]. The quadrate penultimate ventral segment of the male suggests affinity with the smaller forms of *Spongiphora*, especially with *S. pygmea*, but the pygidium of the male is rounded, and the fourth antennal segment is short.

13. *MINOR* Linnaeus.

Philippines.—Bacor, one female (P. L. Stangl).

14. *AURICOMA* Rehn.

Costa Rica.—Piedras Negras (Schild and Burgdorf), one female. Cat. No. 7080. Type of Rehn [1903¹, p. 292].

This species is unfortunately based upon a single female, and so its true position can not be satisfactorily determined until the male is discovered. The short, stout, conical forceps distinguish it from the female of *L. chalybea*. It is probably allied to *L. rotundata*.

15. *NIGROFLAVIDA* Rehn.

Australia.—Queensland, Cairns (Koebele), Cat. No. 8168, one female. Type of Rehn [1905¹, p. 507].

This is a very distinct species. The male has since been described by me [1908⁴, p. 48].

Genus SPONGIPHORA Serville.

1. INSIGNIS Stål.

Colombia.—Cayenne (William Schaus), a broken specimen.

This is Rehn's type of *Sparatta flavipennula* [1903², p. 306]. I refer it to this species, but it is unfortunate that it is a female.

Caudell [1907², p. 173] refers to *Sparatta flavipennula* two larvæ taken by Messrs. Schwarz and Barber in Guatemala (Cacao, Trece Aguas), but they are certainly not the larvæ of this species. They seem to be of some *Sparatta*, but can not be identified with certainty.

2. BRUNNEIPENNIS Serville.

Georgia.—Morrison (C. V. Riley), one male and one female.

Texas.—Colombia, near the Brazos River, "under old leaves," December 15, 1878 (E. A. Schwarz), one male.

3. APICEDENTATA Caudell.

California.—Los Angeles, one male (Coquillett).

Arizona.—"Catalina Springs; *Cereus giganteus*." Original syn-types of Caudell [1905, p. 461].

4. GHILIANII Dohrn.

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz (Schwarz and Barber), one male and one female.

Specimens recorded by Caudell [1907², p. 175] as *Spongiphora pygmæa*. I follow Borelli's revision of the group and so refer these specimens to *Spongiphora ghiliani*.

Genus SPARATTA Serville.

71. PELVIMETRA Serville, var. RUFINA Stål.

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, one female (Barber).

This is the type of *Cylindrogaster diplatyoides* Caudell [1907², p. 170]. It is certainly a female of some species of *Sparatta*, probably of the above species.

72. ARMATA Burr.

Guatemala.—Polochic River, March 22 (Schwarz and Barber), Cat. No. 10367.

This specimen is the type of *Sparatta minuta* of Caudell [1907², p. 172], a female, which I refer here.

Family FORFICULIDÆ.

Subfamily CHELISOCHINÆ.

Genus CHELISOCHES Scudder.

1. MORIO Fabricius.

Hawaii.—Honolulu, one female (Ashmead), Hilo, two females (Brenner).

Philippines.—Negros, ten females (Steere Expedition).

Philippines.—Samar, one female (Steere Expedition).

California.—Menlo Park, one male and one female (F. Hornang) introduced.

Lower Siam.—Trong, one female. Rehn's type of *Chelisoches stratioticus* [1905¹, p. 509, fig. 6]. This is only a finely developed race of *Ch. morio*. I have a specimen from Java, and there is one from Travancore in the Madrid Museum.

Genus PROREUS Burr.

1. MINOR Caudell.

Philippines.—Mindoro, Bacoar, January, 1903 (P. L. Stangl), two males. Caudell's type. Cat. No. 7885, U.S.N.M.

The body is not sufficiently depressed to justify the ranging of this species in *Auchenomus*. In the form of the head, it resembles *P. sobrius* Bormans, but differs in smaller size and slender build

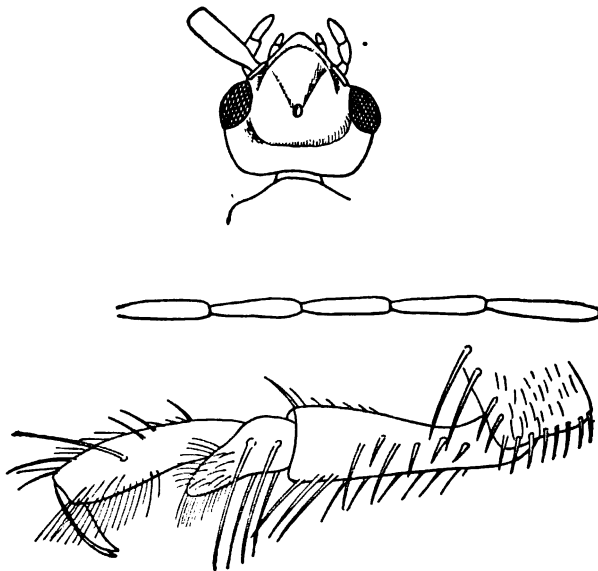


FIG. 2.—HEAD, PART OF ANTENNA, AND POSTERIOR TARSUS OF PROREUS MINOR.

and non-transverse pronotum. In the structure of the head it approaches *P. ludekingi* Dohrn, but differs in the shorter pronotum and non-banded elytra; the coloration at once distinguishes it from *P. laetior*, and *P. variopictus* Bormans, to which it is related (fig. 2).

Subfamily NEOLOBOPHORINÆ.

Genus NEOLOBOPHORA Scudder.

1. RUFICEPS Burmans.

Mexico.—Orizaba, January 9 to 16, 1902 (H. Osborn), one male. [Rehn, 1903², p. 310.]

Mexico.—Jalapa, two males (J. T. Mason), 1902. - [See Rehn, 1902, p. 2.]

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, one female (Barber). [Rehn, 1907², p. 175.]

Guatemala.—Secanguin, December, 1905 (G. P. Gold), larva.

Mexico.—Cordoba, one male (Knab).

Costa Rica.—Volcano de Irazu, January, 1902.

Costa Rica.—San José, "on Indian corn," one female (Dr. Gust. Michaud). Accession No. 20097, female.

Subfamily ANCISTROGASTRINÆ.

Genus ANCISTROGASTER Stål.

1. *GULOSA* Stål.

Mexico.—Cordoba, June 12, male and female (Knab).

Mexico.—Jalapa, January and February, male.

Mexico.—Orizaba, January 16, 1897, male and female (H. Osborn).

2. *SPINAX* Dohrn.

Guatemala.—Polochu River, one male, October, 1905 (C. P. Gold).
The abdominal spines rather feebly developed.

3. *MACULIFERA* Dohrn.

Mexico.—Jalapa, January and February, male and female.

4. *FALCIFERA* Rehn.

= *Ancistrogaster mixta* BORELLI, 1906³, p. 12.

Peru.—Piches and Perene valleys, 2,000 to 3,000 feet (Sociedad geografica de Lima), one male. (Cat. No. 8172.)

Type of Rehn (1905¹, p. 510, fig. 7.)

Mexico.—Cordoba, January 27, 1908, male and female (F. Knab).

This is identical with *A. mixta* Borelli. The slightly differently tinted antennæ, the absence of the small red humeral spot on the elytra and basal spot on the wings, which are present in *A. mixta* are not sufficiently stable characters to justify the discrimination of these two species, and so the name *A. mixta* must be sunk as a synonym (fig. 3).

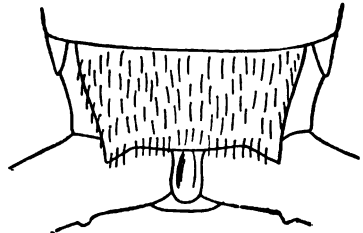


FIG. 3.—PENULTIMATE VENTRAL SEGMENT OF A MALE ANCISTROGASTER FALCIFERA.

5. ——— Species?

Mexico.—Jalapa, January and February, one female.

6. ——— Species?

Peru.—Chanchamarja (Rosenberg), a fragment.

Genus VLAX Burr.

1. *TOLTECUS* Bormans.

Mexico.—Orizaba, January 9 to 16 (H. Osborn), two males. [See Rehn, 1901, p. 219, and 1903², p. 308.]

Genus PRAOS Burr.

1. *PERDITUS* Borelli.

Costa Rica.—Volcano Irazu, February 6, 1902, two males.

Genus *OSTEULCUS* Burr.1. *KERVILLEI* Burr.

Venezuela.—Merida, one female.

Subfamily *OPISTHOCOSMIINÆ*.*PILEX*, new genus.

Antennæ? (only the basal segment remains; this is short and stout.)

Head tumid, eyes very large.

Pronotum subquadrate; about as wide as the head and wider than long, and a little broader posteriorly than anteriorly.

Elytra and wings well developed, ample, the former not carinate.

Legs long; first tarsal segment cylindrical, about half as long again as the other two united; second broad, but distinctly longer than broad; third longer than the second, but only about half as long as the first, rather broad.

Abdomen broad, depressed, subparallel.

Last dorsal segment ample, rectangular, transverse about twice as broad as long.

Pygidium distinct, obtuse, transverse.

Forceps with branches remote at the base, elongate.

This genus is erected for *Opisthocosmia bogotensis* Rehn, which falls into the group with noncarinate elytra and broad pronotum; the short third segment of the tarsi connects it with *Eparchus*, *Hypurgus*, and *Skalistes*, but the depressed body, and transverse last dorsal segment, distinguishes it easily.

1. *BOGOTENSIS* Rehn.

Colombia.—Bogota (G. Klages, Cat. No. 8166; Rehn, 1905, p. 511, fig. 3).

This species is figured and well described by Rehn. It has a number of peculiarities which make it easily recognizable. The asperities of the forceps and last dorsal segment, the anchor-shaped depression in the latter, the build and form of forceps, together with the generic characters, are very distinctive.

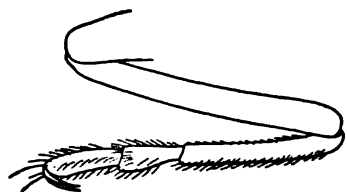


FIG. 4.—HIND LEG OF *PILEX* *BOGOTENSIS*.

The second segment of the tarsi is scarcely lobed, merely a little dilated toward the apex, scarcely more so than the third segment; this is a very striking contrast to certain species of *Eparchus*, as *E. lugens*, where the second segment is almost circular and the third slender.

The large and prominent eyes are very noticeable; as they almost reach the posterior angles of the head, they have an archaic character, recalling the fossil genus *Labiduromma*. The type in the U.S. National Museum is the only known specimen (fig. 4).

Genus *SARCINATRIX* Rehn.

Rehn proposed this as a subgenus in 1903², page 308, for his species *S. anomalia*.

The following year I raised it to generic rank and included in it *Opisthocosmia americana* Bormans and *Sarcinatrix rehni* Burr.

But an examination of Rehn's type shows that the genus is essentially ancistrogastrine, having not only a feeble, yet distinct, costal keel on the elytra, but the horns of the penultimate ventral segment are merely a highly developed form of the points or lobes of that plate which characterize the subfamily Ancistrogastrinæ.

Sarcinatrix therefore remains monotypic, *S. americana* Bormans and *S. rehni* Burr being removed to a new genus.

1. *ANOMALIA* Rehn.

Costa Rica.—Turrialba and San Carlos, one male and two females (Schild and Burgdorf). Rehn's types [1903², p. 308].

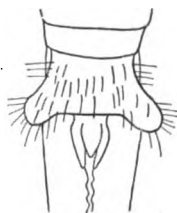


FIG. 5.—PENULTIMATE VENTRAL SEGMENT OF *SARCINATRIX ANOMALIA*, MALE.

DINEX, new genus.

Abdomen convex, feebly depressed and feebly dilated; antennæ with segments cylindrical, fourth longer than third; pronotum nearly square; elytra and wings ample, smooth, former with no keel; tarsi with first and third segments about equally long; last dorsal segment transverse, ample, sloping, not narrowed; penultimate ventral segment transverse, more or less rounded posteriorly.

Type of the genus.—*Opisthocosmia americana* Bormans, 1893 [p. 8, pl. 1, figs. 22–23].

I form this new genus for *Opisthocosmia americana* Bormans and *Sarcinatrix rehni* Burr, both Neotropical forms. Both of these I formerly included in Rehn's subgenus *Sarcinatrix*, which I raised to generic rank.

But, as I have shown in my remarks on the genus *Sarcinatrix*, the elytra of that genus have a keel, though indistinct, and the penultimate ventral segment of the male has the horns which are characteristic of the *Ancistrogastrinæ*.

We must therefore exclude from it the two above-mentioned species which can not fall back into *Opisthocosmia*, which is now a purely oriental genus with a narrow pronotum. A new genus is accordingly required for these two species.

1. *AMERICANA* Bormans.

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, one male and two females (Schwarz and Barber). Originals of Caudell [1907², p. 175].

2. ——— Species.

Philippines.—Mindoro, Malabang (Portello), one male in poor condition.

3. ——— Species.

Philippines.—Mindanao, Marabini, two females.

Genus SKALISTES Burr.

1. LUGUBRIS Dohrn.

Mexico.—Orizaba, January 9 to 16, 1897 (H. Osborn). Rehn's type of *Forficula metrica* [1903², p. 311].

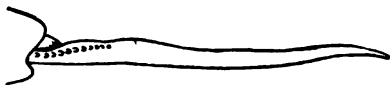


FIG. 6.—PROFILE OF FORCEPS (FROM INSIDE) OF MALE SKALISTES LUGUBRIS, VAR. METRICA.

This is only a *macrolabia* variety of *S. lugubris*; the elongation of the forceps has caught the vertical tooth and produced it into a

crest, thus entirely altering the appearance of the creature.

Also typical male and two females from same locality.

2. CACAOENSIS Caudell.

Guatemala.—Cacao, Trece Aguas, Alta Vera Paz, at about 900 feet (Schwarz and Barber). Cat. No. 10370, Caudell's type [1907², p. 175].

This species is related to *S. lugubris*, but the pronotum is less depressed, the elytra smoother and less hairy, the pygidium scarcely discernible, and the forceps are quite different.

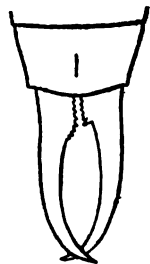


FIG. 7.—FORCEPS OF MALE SKALISTES CACAOENSIS

Subfamily ANECHURINÆ.

Genus ANECHURA Burr.

1. HARMANDI Burr.

Japan.—One male and five females.

This is the typical species of *Odontopsalis* Burr, but I now prefer to consider this as not generically distinct from typical *Anechura*.

CIPEX, new genus.

Build slender.

Antennæ slender and cylindrical, the third and fourth segments about equal.

Pronotum subquadrate, rounded posteriorly.

Elytra not keeled, ample; wings ample.

Sternal plates rather narrow.

Feet short, tarsi shorter than the tibiae; all three segments about equal in length; first stout, second strongly dilated, third slender.

Abdomen long and parallel.

Pygidium: male large, tumid, and subglobulose, spined; female, similar, with no spine.

Last dorsal segment, male and female, transverse.

Forceps with branches remote at base, elongate, slender in both sexes, with strong teeth in the male.

This genus is erected for the remarkable earwig from Cuba described under the name of *Forficula schwarzi* Rehn, which is the type.

In spite of the narrow sternal plates and elongate body, it has all the appearance of the *Anechurinae*, especially the peculiar pygidium.

It is well characterized by the tarsi, which are quite different from those of any other known genus of the subfamily.

1. SCHWARZI Rehn.

Forficula schwarzi REHN (1905¹), p. 513, fig. 9.

Sphingolabis schwarzi CAUDELL (1907¹), p. 170.

Cuba.—Santiago Province; Cayamas, March 4. One female (Schwarz, Cat. No. 8169, Rehn's type); same locality, one male, May 25 (Schwarz, the original male first described by Caudell).

This elegant species was first described from a single female in poor condition; the abdomen had been broken off and in repairing had been cemented on upside down. The same collector later took a male in the same locality, which is described by Caudell.

An examination of these two specimens, the only ones so far known, shows that the pygidium is, in its essentials, typical of the *Anechurinae*, to which subfamily I have little hesitation in referring it.

Superficially, in color and general appearance, it must resemble the little-known *Anechura elongata* Bormans, likewise from Cuba, but the form of the pygidium and forceps is different.



FIG. 8.—TARSUS OF *CIPEX* SCHWARZI.

Subfamily FORFICULINÆ.

Genus DORU Burr.

1. LINEARE Escholtz.

Mexico.—Orizaba, May 8, one male (Howard), a large, dark, banded specimen. [Rehn, 1901, p. 219, 1903², p. 310.]

Mexico.—Orizaba, January 9 to 16, 1907 (H. Osborn), a pale, small banded specimen. [Rehn, 1903², p. 310.]

Mexico.—Pancajihi (D. P. Roll), May, 1905; a small, dark specimen.

Guatemala.—Livingtone, February 18, 1905, one female. (Charles C. Dean).

Mexico.—Cordoba, two males; fine, bright, big, dark specimen.

San Salvador.—One female (Knab); a small, dark, yellow specimen.

San Salvador.—Sonsonate, August 19, 1908 (Knab), one male and one female.

Mexico.—Cordoba, one female "at light" (Knab).

Guatemala.—Sapachiti, April, 1902, one female (R. F. Griggs).

Guatemala.—Alta Paz, Secanquin, cotton field, one male (A. MacLachlan).

Mexico.—One female.

Paraguay.—Sapucay, male and female (W. Foster); a small, red male and female. [See Rehn, 1907², p. 151, and Caudell, 1904, p. 181.]

Brazil.—Bonito, Province of Pernambuco, "on cotton," January 5, 1883, three females and a bleached male. Same locality, five females and three males of the *californica* form. [See Rehn, 1903², p. 310.]

Venezuela.—Merida, one male and two females (S. Brieno).

Mexico.—Orizaba, January 9 to 16, 1897 (H. Osborn), var. *californica*; det. Rehn [1903², p. 310].

Texas.—Brownsville, November, 1904 (H. S. Barber), one male, determined by Caudell as *A. exilis*. I do not know the true *exilis*, but consider this identical with the var. *californica*.

Arizona.—Tucson, one male.

Cuba.—Cayamas, one male and one female (Schwarz).

I look upon this as a rather variable and widely distributed species; I consider *texniata*, *luteipes*, and *aculeata* as synonyms; also *californica*, which is a variety; also *gracilis* and *suturalis*; perhaps *exilis* is distinct.

Rehn agrees in regarding *californica* as a mutation. Caudell is right in adopting Eschscholtz's old name.

The development or abbreviation of the wings, the presence or absence of a tooth on the forceps, the intensity of coloration, the breadth of the bands on the elytra, are not features which, in my opinion, justify specific rank. It may be possible to show, when all the available material has been critically examined, that some of the forms are restricted to certain localities, in which case they become local races, or variation in the sense as defined by Staudinger, Tutt, and other lepidopterists.

2. *ALBIPES* Fabricius.

Santo Domingo.—San Francisco Mountains, two males and one female (Busck).

These are Caudell's original specimens [1907¹, p. 169]. Perhaps *albipes* Fabricius and *bimaculata* Fabricius are identical.

Genus ELAUNON Burr.

1. *ERYTHROCEPHALA* Olivier.

Liberia.—Mount Coffee (G. P. G.). [See Rehn, 1905¹, p. 513.]

Congo.—Liedo, one male and one fragment.

Genus FORFICULA Linnæus.

1. AURICULARIA Linnæus.

Tasmania.—One male, No. 443 (Webster).

Tasmania.—Nos. 4431 and 744.

Norway.—Kristiania, one female (Strand), Bergen, one female (Strand).

Germany.—Leipzig, November, 1877 (Professor Turner), one female, October 21, 1879, labeled "*F. decipiens*."

Prussia.—Stettin, one female, August, 1898 (Pergande).

Azores.—Flores, male and female (W. Trelease). [See Rehn, 1905¹, p. 513.]

2. DECIPIENS Gémé.

Italy.—One female (Leonardi).

"*Europe*."—"From nest of brown tail moth," No. 7567, 1905-6, female.

3. ——— Species?

Peru.—Piches and Perene valleys, 2,000 to 3,000 feet (Sociedad geografica de Lima), one female.

SYNONYMS ESTABLISHED.

Bormansia meridionalis Rehn (not Burr)... = *Karschiella* cf. *camerunensis* Verhoeff.

Labidurodes magnificus Rehn..... = *Allostethus indicum* (Hagenbach).

Echinopsalis brevibractea Rehn..... ? = *Pyragra fuscata* Serville, larva.

Pygidicrana peruviana Rehn..... = *Pyragra dohrni* Scudder.

Arthrodoetus barberi Caudell..... = a *Pyragrid* larva.

Psalis pulchra Rehn..... ? = *Psalis percheron* (Guerin).

Apterygida buscki Rehn..... = *Psalis gagatina* Klug, var.

Anisolabis minuta Caudell..... = *Borellia stål*i (Dohrn).

Brachylabis nigra Caudell (not Scudder)... = *Leptisolabis howardi*, new species.

Labia pulchella Serville..... =

Labia guttata Scudder..... =

Labia burgessi Scudder..... =

Labia melancholica Scudder..... =

Labia flaviscuta Rehn..... =

Labia chalybea Dohrn..... =

Labia arcuata Scudder..... =

L. unidentata (Palisot de Beauvois).

Labia annulata (Fabricius).

Sparatta flavipennula Rehn..... = *Spongiphora insignis* (Stål).

Spongiphora pygmaea Caudell (not Dohrn)... = *Spongiphora ghilianii* Dohrn.

Cylindrogaster diplatyoides, Caudell..... = *Sparatta pelvimetra* Scudder, var. *rufina* Stål.

Chelisoches stratioticus Rehn..... = *Chelisoches morio* Fabricius, var.

Sparatta minuta Caudell..... = *Sparatta armata* Burr.

Ancistrogaster mixta Borelli..... = *Ancistrogaster falcifera* Rehn.

Forficula metrica Rehn..... = *Skalistes lugubris* (Dohrn, var.).

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ON A NEW LABRADOREAN SPECIES OF ONCHIDIOPSIS,
A GENUS OF MOLLUSKS NEW TO EASTERN NORTH
AMERICA; WITH REMARKS ON ITS RELATIONSHIPS.

By FRANCIS N. BALCH,
Of Boston, Massachusetts.

During the summer of 1908 Mr. Owen Bryant, cruising on the Labrador coast, made opportunity for some dredgings in moderate depths. The resulting mollusks, with the exception of the Nudibranchs, were placed in the hands of Mr. C. W. Johnson, curator of the Boston Society of Natural History. The small collection of Nudibranchs was intrusted to me. In it was included an apparently naked mollusk, which Mr. Bryant took for a dorid form, but which is in fact a fine new species of the internal-shelled genus *Onchidiopsis* belonging to the family Lamellariidæ. Mr. Bryant's mistake was far from unnatural, and it is possibly owing to similar errors on the part of other collectors that we owe almost all our knowledge of the group to specialists on the Opisthobranchiata (especially the Nudibranchs), as will appear from the literature cited at the end of this paper.

The specimen is a fine adult, well preserved in formol, and is of interest from several points of view—first, from the point of view of geographical distribution, the genus being previously unknown from eastern America, though present in Greenland and Alaska; second, from the point of view of systematic morphology, the genus being probably the last term of an extraordinary aberrant series and containing few, perhaps only one, hitherto known species; third, from the point of view of teratology, since the specimen has a bifid left tentacle the abnormal member of which bears what appears externally to be an extra eye resembling the normal, but proves on sectioning to be a group of four eyes apparently proliferating one from the other, in various stages, making a case quite unique so far as the records show.

The present paper contains a description of the specimen, with a brief discussion from the first and second points of view. The teratological aspect was presented in a separate paper read before the American Society of Zoologists (Eastern Branch) during convocation week in Boston, December, 1909, and which, it is expected, will be published in the *American Naturalist*.

Out of a desire not to mutilate the single specimen more than necessary, examination has been confined to external points and to the

internal shell, the radula and pharyngeal bulb, the features of the gill-cavity, and the anatomy and histology of the bifid left tentacle. The material, consisting of the partially dissected body in formol, the shell in formol, and a mount of the radula, has been deposited in the U. S. National Museum.

The description follows:

ONCHIDIOPSIS CORYS,^a new species.

Locality.—Single specimen dredged off Fish Island, outside Hebron Harbor, Labrador, in 75 fathoms, mud, August 26, 1908.

Size.—In formol: Length, 20 mm.; breadth, 16 mm.; height, 14 mm.

Color.—In life: Cream colored, with 8(?) spots of varying shades of brown [Bryant's notes]. In formol: Notæum, ground-color light purplish brown with darker markings on the lower sides, faintly and vaguely reticulated over the top and upper sides, so as to give the effect of about twelve ill-defined blotches of the ground color. Anterior lobes lighter and more yellowish. Head and foot same as ground color of notæum. Eye spots black.

General form.—(Pl. 21, figs. 1, 2, 3.) The notæum, smooth on top and sides, wrinkled or strongly folded and vesiculate elsewhere, rises in a backward-tilted dome, suggesting a Grecian helmet (whence the name chosen), the curiously puffed and wrinkled anterior border projecting visor-fashion. The top and sides of the notæum are closely applied to the thin internal shell, which in turn closely covers the large dome-shaped visceral hump. Below the folded border of the notæum are seen the well-demarcated head and the foot, the former bearing a large proboscis of truncated-cone shape, and two thick tentacles about as long as the proboscis, with conspicuous eye spots about two-thirds way up from their bases. The foot in the preserved specimen is of moderate size, reaching anteriorly only to the level of the tentacles and posteriorly projecting about one-sixth of its length beyond the border of the notæum, the projecting portion sharply upturned. The very large penis, situated on the right side of the neck, comes partially into view below the notæum above the right tentacle.

Notæum.—Smooth to the naked eye (actually finely wrinkled), thin, and closely investing the thin internal shell on the top and sides; the lower sides more wrinkled; the border thickened, strongly folded, and vesiculate or puffy; the anterior border quite specialized, being very strongly folded, and vesiculate or pustulate, so as to present the appearance of a mass of crowded water blisters. This anterior lappet projects like a visor or eye shade over the head and is cut by the deep inspiratory cleft (lying just to the left of the median line) and the less deep expiratory cleft (lying about 65 degrees to the right, and rather a fold than a cleft) into a well-demarcated right and a much less well-marked left lobe. In life these anterior lobes or lappets evidently play an important part, as they are large, muscular, and

^a *Κόρυς*, signifying an homeric helmet.

highly specialized. Probably they are concerned in respiration and also furnish an extensible, thick, and soft sort of cushioned armor for the head, which lacks the ordinary defense of withdrawal under a shell.

Shell.—(Pl. 21, figs. 4, 5, 6.) On cutting open the notæum the shell appears as a quite transparent whitish film closely applied like a cap to the top and front of the solid dome of the visceral hump. Not being adherent either to the notæum or to the true mantle (which lies below it as a transparent membrane investing the visceral hump) it can be simply lifted out with forceps. It has about the appearance and consistency of a film of collodion. It is not stiff enough to resist the action of gravity in air, but has sufficient elasticity to regain its form when restored to a liquid medium. It is smooth except for rather faint concentric lines of growth. In general shape it may be roughly likened to a very highly arched finger-nail. A peculiar and instructive feature is the infolding of the posterior-inferior portion into the posterior-superior portion. A comparison of Pl. 21, figs. 7, 8, and 9, will make clear what has happened. Figs. 7 and 8 are rough representations of the shells of *Marsenina prodita* (Lovén) and *M. ampla* (Verrill), respectively. The former is lymnoid. The latter is more degenerate and consists of only one whorl, mostly mouth. Fig. 9 is a diagrammatic sketch of our shell represented as a solid object. The homology of the infolded portion is plain. The last whorl, becoming degenerate to the point of abandonment and reduced to a mere posterior wall of the mouth space, has simply collapsed into the spire cavity. This is not, however, a mere accidental collapse, as wet paper might collapse upon itself. It is structural and permanent. The infold, if straightened out, springs smartly back again and the line of folding is clearly marked structurally. The cavity of the last whorl (i. e., the space between the infold and the top of the shell) has been abandoned by the animal and practically obliterated. In this and other obvious respects the infold materially differs from the "deck" or "shelf" of *Crepidula*, with which, however, it is somewhat parallel. In the other species of *Onchidiopsis* there is no such structure, so that in this respect the present species serves to connect the genus as hitherto known with more normal forms and offers an instructive study in the degeneration of shell armor. The shell in the present species differs from those hitherto described in presenting neither lateral emargination nor wing.

Visceral hump.—Next below the thin membranous true mantle already mentioned lies the solid smooth dome of the visceral mass, purplish-yellow in color, the visible portion chiefly consisting of the glands of the genital system. It is larger than the shell, which only partially covers it, but the discrepancy is not so great as in the other species of the genus, where the shell is little more than a scale over the gill-cavity region, while here the whole top and sides of the visceral hump are covered. In the gill-cavity region the black base of the large osphradium showing through the roof of the cavity is conspicuous.

Gill cavity and branchial complex.—The large thin-roofed branchial cavity opens by a long and narrow crescentic horizontal slit just above the nuchal fold. On opening it the most conspicuous object is the osphradium running diagonally across the left side of the roof and consisting of a double series of leaflets (Pl. 21, fig. 10) set on either side of a central rhachis after the usual fashion, but very large and having the side edges and basal edges of the leaflets black. It differs markedly in the shape of the leaflets (which are distinctly bilobed) from the other species of the genus. Beside it, on the right, the gill, though larger, is much less conspicuous. Its thin leaflets, colored like the neighboring tissue, arranged in a single row on the right of the rhachis, are long and narrow compared with those of the other species of the genus, and simply pointed. The anus was not satisfactorily made out, the right-hand part of the roof of the gill cavity (where it doubtless lies, as in the other species) having been disturbed in the examination of other parts.

Genital system.—This was only examined externally, but nothing appears to cast doubt on its substantial conformity with the other species of the genus. The female genital opening was not satisfactorily made out, the region near the anus where it should occur having been disturbed, as above stated. The penis (Pl. 22, fig. 1) is extremely large (quite double, in proportion, that figured or described for the other species) and otherwise peculiar. Arising from the nuchal fold on the right side of the neck, above and just to the left of the base of the right tentacle, is a massive base as thick as the base of the tentacle itself and half again as long as broad, directed backward and slightly outward and upward. Sharply turning more than a right angle (so that it runs forward, and slightly outward and downward) the organ now rapidly diminishes in size to a slender neck of less than a quarter the original diameter. The minimum size is, however, scarcely reached before the organ suddenly swells again (though this time only slightly) at the same time acquiring along its external margin a great crest recalling in form and proportion the conventional mane of the chess knight. The crest rapidly diminishes and at the point where it is lost the organ suddenly bends directly back upon itself, at the same time diminishing to a point which reaches back to the level where the crest began. A fair idea of the relations of the parts can be given by comparing the whole structure to an arm, the upper arm enormously fat, the forearm starting fat but rapidly dwindling to a thin wrist, the hand and fingers very long, and the back of the hand expanded into a high crest. In attitude the arm must be strongly flexed and the fingers pressed together at the tips and impossibly flexed so as nearly to touch the inside of the wrist. The finer structure was not examined. Bergh has minutely described it for the related species.

Head.—The broadly ovoid body mass is bounded in front by a strong nuchal fold clearly marking the transition to the head region,

which widens again beyond it. The region is about twice as broad as long and is prolonged at its anterior corners into the tentacles, while from its anterior face springs the snout or rostrum.

Tentacles and eyes.—(Pl. 22, fig. 1.) The tentacles are thick, fleshy, and moderately wrinkled, ending in an abrupt taper. In life they are doubtless somewhat longer and thinner, but the contraction in this specimen does not appear to have been extreme. They curve gently outward and upward. Each bears on its external (and slightly superior) surface a large black eye spot, which appears as a lump under the skin, raising the latter into a slight prominence out of which the eye looks forward along the tentacle. In effect the eye is set in the anterior face of a very rudimentary peduncle or ophthalmophore resembling a bracket. On sectioning, the eyes are seen to present no special features, but are well developed and evidently highly functional. There is no appearance of any corneal modification of the skin except a slight thinning. The retina is heavily pigmented; the lens large, filling nearly the whole eye cavity. The left tentacle in this specimen bore an appendage branching off from its base and pointing posteriorly along the left side of the neck, nearly as long as the tentacle itself but less than half as thick. This appendage bore on its exterior face an extra eye, or rather, as heretofore mentioned, a cluster of four extra eyes apparently in various stages of proliferation one from another. Undoubtedly the whole structure (neglecting the feature of the apparent proliferation of eyes in the extra eye spot) is to be interpreted as a case of bifid left tentacle somewhat masked by the turning backward of the external member and its reduction in size and change in proportions. If this member were turned forward and thickened and curved like the normal tentacle, it and its eye spot would bear the relation of a mirror image to the normal tentacle and its eye spot, as is commonly the case with similar bifid structures.^a

Rostrum and mouth.—(Pl. 22, figs. 1, 2, 3.) From the anterior face of the head region, and from under a fold of skin connecting the bases of the tentacles, springs the thick and heavy rostrum in the shape of a truncated cone about once and a half as long as broad. It is only moderately wrinkled and, like the tentacles, is in life probably somewhat but not greatly more protrusible. It may probably be also somewhat more contractile but not greatly. The thick and heavy skin and the rather slight musculature which appear on dissection do not point to an extremely elastic or contractile organ. Its anterior end forms a flat face of oval form, the major axis dorso-ventral. In this axis the mouth appears as a simple slit two-thirds the length of the oval, with wrinkled lips. Unless the rostrum is much more changeable in form than above supposed it differs markedly from the other species of the genus, where it is bulbous. Doubtless the pharyngeal

^a See cases collected in Bateson [1894].

bulb can be pushed forward, but even this could hardly produce such forms as figured by Bergh.

Jaws.—(Pl. 22, figs. 2, 3, 4.) The mouth opens into a narrow tube of oval section, thin walled, and running between the two jaws which arch it over and also partly inclose its sides. The jaws are of brown chitin, thin and delicate, about twice as long as high, serrate on their lower edges, the serrations growing coarser from posterior to anterior. Each jaw is molded to fit along the top and one side of the mouth tube, narrows to a rounded point posteriorly and appears to be squarely and smoothly cut off anteriorly; but about this last there may be some doubt since there is a suspicion that in removing these delicate objects from the tough mouth gristles, serrations or other structures at the point of attachment may have been broken off and lost. To the powers of the dissecting microscope the jaws appear covered with beautifully regular minute transverse (i. e., dorso-ventral) striations corresponding in spacing with the serrations of the ventral edge. The real microscopic structure was not studied. There can be little doubt it is substantially that several times figured by Bergh for similar objects, i. e., a sort of mosaic of minute chitinous bars locked together in a diamond pattern which gives the impression of transverse (i. e., dorso-ventral) lines, the longitudinal (i. e., antero-posterior) lines being broken in the pattern.

Pharyngeal bulb and radula.—(Pl. 22, figs. 2, 3, 5, 6.) Near the posterior end of the jaws the thin-walled mouth tube suddenly swells to more than twice its former diameter to contain the large muscular pharyngeal bulb. The structure of this was not minutely studied as it offered no prospect of material difference from the similar organs so often and fully elucidated by Bergh. Its form sufficiently appears from the figures and must in life vary greatly in the course of the complicated motions of the radula which latter, however, in this species I think is almost certainly not protrusible. I think so, both because the mouth and end of the snout are too small and because there is a pretty clear mutual adjustment of the radula and jaws to trituration of the food between them in the swollen portion of the mouth tube. The radula commences posteriorly in a bulb borne on a long stem which is a prolongation of the posterior base of the pharyngeal bulb but rises sharply upward and to the left, penetrates the dorsal wall of the mouth tube, then curls over forward and outward and lies on top of the mouth tube at its widest part to the left of its center. The radula, starting in this bulb, passes down through its stem and so into the lower posterior part of the pharyngeal bulb, through which it then turns sharply upward, reaching its surface (and so coming into use in the open mouth-cavity) at the highest point of the bulb's top. At the same point the radula attains its own greatest width, for by wearing off of the lateral members and by appression it thence slightly narrows as it runs forward down the anterior slope of the pharyngeal

bulb, ending abruptly shortly after passing within the jaws. It attains a length of 60 transverse rows and is typically taenioglossate, having the usual formula 2-1-1-1-2. The median or rhachidian tooth consists of a base about as wide as high, with slightly convex lower edge and concave sides, the top of which curls over backward to form the dentate functional blade. The latter bears a large central cusp, long and pointed, flanked by very irregular and much smaller denticulations, about eight on each side but varying from six to ten and showing a distinct tendency to alternation of larger and smaller. The whole tooth is arched, with the convexity posterior, so that the functional upper portion as seen from on top has a roughly crescentic form. The laterals, or ad-medians, are on the same general plan, but the basal portion is much narrower and higher, the central (or sub-central) cusp longer in proportion and flanked by about seven denticulations on the external and five on the internal side. They are set on the basal membrane at an angle with the rhachis, so that the central cusps point slightly inward. The uncini have the form of simple smooth arched claws, curving upward, backward, and slightly outward. By folding inward over the admedians they can be laid flat. Possibly they can also be folded outward. The radula presents only minute differences from the other species of the genus so far as comparison with figures shows.

Foot.—(Pl. 21, figs. 2, 3; Pl. 22, fig. 1.) Moderate in size, as before described, anteriorly slightly bowed and concave, posteriorly obtusely pointed. The anterior angles form distinct stout lobes or auricles. The posterior portion, projecting beyond the notæum border, is somewhat specialized, being slightly broader and thicker than at the point where it passes beneath the notæum, and curled sharply upward. This might be thought to be a mere accident of preservation in this specimen, but has been described for other species of the genus. Whether it occurs in life or is due to the strong contraction in death of the structure next mentioned is uncertain. The dorsal surface of the foot is appressed to the edge of the notæum where it passes beneath it, and at and posterior to this point bears a narrow central muscular thickening or pad. Similar structures have been minutely described by Bergh for other species of the genus. The function is unknown but does not its position suggest that it may be merely a vestigial operculiferous lobe?

Parasites.—On sectioning the left tentacle two large encysted parasites were found, complex organisms, probably Trematodes. Prof. Henry B. Ward, of the University of Illinois, is kindly examining them and it is hoped to present further conclusions in connection with the forthcoming paper in the American Naturalist. The highly abnormal character of this tentacle and its parasitization may possibly be more than a coincidence. Nematodes have been found with the larvæ of *O. grænlandica* (Bergh [1887], p. 276, note).

RELATIONSHIP OF THE PRESENT SPECIES TO THE OTHER SPECIES OF THE GENUS.

The names applied to species now considered to belong to *Onchidiopsis* are few, being in chronological order as follows:

Coriocella carnea Krøyer [1847], p. 115, no. 10.

Coriocella recondita Krøyer [1847], p. 115, no. 11.

Lamellaria glacialis M. Sars [1850], p. 185.

Onchidiopsis grænlandica Bergh [1853], p. 346.

Onchidiopsis reinhardi Beck. Mörch [1868], p. 25.

Onchidiopsis grænlandica, var. *pacifica* Bergh [1887], p. 278.

Onchidiopsis palliata Lovén (unpublished, a label name, teste Poselt [1898]).

Of these *recondita* is the young of *carnea*; *palliata* and *reinhardi* were both applied to unusually large specimens of *grænlandica* (*reinhardi* said to be over three inches long); and *carnea* itself is now treated as a full synonym of *grænlandica*.^a

This leaves only *glacialis* Sars, and *grænlandica* Bergh with its var. *pacifica* Bergh. The real status of these forms is in the highest degree problematical. All are strictly boreal, and Bergh is the great authority on them. Unfortunately his last publication on the group—in his great monograph of the Marseniadæ (Bergh [1887])—while very full and elaborate, does not do its author justice. The text and plates are repeatedly in disagreement, and the former has been found blind by others besides the present writer. Among other things, both description and figures appear to show that *grænlandica*, var. *pacifica* is in reality nearer to *glacialis* than it is to *grænlandica*, being a variant in the same direction as *glacialis* but more extreme. But Bergh himself evidently felt great doubt whether he was in fact dealing with more than one species in all. With the growth of his work on the genus, and the accumulation of more material, his species, at first fairly well distinguished, have approached each other more and more, till he finally relies for the discrimination of *grænlandica* from *glacialis* on the fact that in the former the shell is broader behind, the osphradium black on its base, the gill leaflets of "somewhat peculiar form," and the inner members of the pairs of uncinal hooks not denticulate. As to this last character, which seems the best of the lot, *pacifica* (which Bergh treats as a variety of *grænlandica*) has the hooks more strongly denticulate than *glacialis* itself!

Bergh says Sars confused the two species. Friele [1901, p. 68] has not hesitated to unite them, though without discussion. Knipowitsch [1902, pp. 361–363] retains them nominally separate, though conclud-

^a Krøyer's name *carnea* is earlier than *grænlandica* but is a *nomen nudum* (see remarks in bibliography) and dates only from Bergh's habilitation of it in 1853. This is also the date of the more familiar *grænlandica* Bergh, which luckily may be retained as having page priority.

ing, after some discussion based on considerable material (all from one locality, however), that *grænlandica* is at most a variety of *glacialis*. He did not have *pacifica* before him. He found that four out of the eight specimens which he separated as *grænlandica* from his single specimen of *glacialis* had black osphradia, but one of them had also denticulate uncini.

The present species is evidently fully congeneric, but is much farther from any of the above forms than any of them are from one another. It is impossible to say to which it comes nearest. Like *grænlandica*, it has an osphradium with black base and nondenticulate inner uncinal hooks in the radula. In the median tooth ("rhachis" of Bergh), and in the character of the notæum, it is nearer *glacialis*. In the very peculiar penis it is perhaps nearest *pacifica*. But in the smooth notæum with reticulate pattern, the extraordinary penis, the shape of the jaws, the shape of the osphradium leaflets, and above all in the structure of the shell, it is sharply distinguished from any of them; while there are minor points of individuality in the radula, the shape and musculature of the rostrum, the form of the tentacles and proportion of the eyes, the form of the body and notæum (especially the anterior lappets), and the shape of the gill leaflets.

It would seem that the species of the genus should for the present be written as follows:

O. glacialis (Sars, 1850), colorless osphradium, slightly denticulate uncinal hooks, comparatively smooth notæum, gill leaflets not auriculate at tip. Distribution paleo-boreal and arctic.

O. glacialis, var. *grænlandica* Bergh, 1853 (syn.: *carnea*, *recondita*, *reinhardti*, *palliata*), osphradium with black base, nondenticulate uncinal hooks (occasionally denticulate), warty notæum, gill leaflets auriculate at tip. Distribution paleo-boreal and arctic.

O. glacialis, var. *pacifica* Bergh, 1887, osphradium as in last, uncinal hooks usually strongly denticulate (sometimes smooth), rhachis peculiar, penis peculiar, notæum as in last. Distribution pacifico-boreal.

O. corys, new species, osphradium with black base but peculiar form, uncinal hooks smooth (in the unique specimen), notæum (top) smooth, gill leaflets not auriculate, penis peculiar. Distribution neo-boreal (?). (Further distinguished from the *glacialis* forms by shell, etc., as elsewhere stated.)

THE RELATIONSHIPS OF ONCHIDIOPSIS TO OTHER GENERA OF LAMELLARIIDÆ.^a

The Lamellariidæ constitute a small, highly aberrant, and somewhat heterogeneous family, treated by Bergh as distinct from the Velutinidæ and containing only the genera *Chelynotus*^b (Swainson) Bergh, *Marsenia* Leach [= *Lamellaria* Montagu], *Marseniella* Bergh, *Marseniopsis* Bergh, *Marsenina* Gray, and *Onchidiopsis* (Beck) Bergh. The Velutinidæ, however, are included in the same group

^a Called by Bergh and some others Marseniadæ, but luckily the more familiar name *Lamellaria* for the typical genus appears to be correct under the International Rules, rather than *Marsenia*.

^b Better treated as a subgenus of *Lamellaria*.

by Woodward [1880], Tryon [1886], Fischer [1887], Cooke [1895], Simroth [1896-1907], and most other systematists, some calling the resulting family Lamellariidæ, some Velutiniidæ.

Bergh himself recognized that the genera *Onchidiopsis* and *Marsenina*, at least, might be united with the Velutiniidæ were it not that on the other hand they connect through the puzzling genus *Marseniopsis* with the irreconcilable genera *Chelynotus*, *Lamellaria*, and *Marseniella*.

Bergh summarized his views in the following:

CONSPECTUS GENERUM.

Plica expiratoria nulla.	[<i>Armatura lingualis</i>] 1-1-1	{	Pars inf. vas defer. non libera.....	<i>Chelynotus</i> Sw.	} diœcious.
			Pars inf. vas defer. libera {	<i>Marsenia</i> Leach [= <i>Lamellaria</i>] <i>Marseniella</i> Bergh	
Plica expiratoria	3-1-3	{	Test. int. calcarea.....	<i>Marseniopsis</i> Bergh	
			Test. semi-int. calcarea...	<i>Marsenina</i> Gray	} monœcious
			Test. int. cornina.....	<i>Onchidiopsis</i> Bergh	

It is apparent that, but for the contradictory characters of *Marseniopsis*, the genera would fall apart in two well-marked groups, which may be called the *Lamellaria* group and the *Onchidiopsis* group, the latter then clearly uniting with the Velutiniidæ, which agree in every essential respect, especially dentition and hermaphroditism,^a except that the shell is still external and, of course, the expiratory fold is therefore not developed.^b In short, the group considered as a whole would appear as either monophyletic but sharply divergent, or as di-phyletic and partially convergent.

The introduction of *Marseniopsis* into the scheme makes any orderly phylogenetic interpretation impossible—that is to say, it makes any *true* arrangement impossible. We must, therefore, for any conclusion, await new facts, particularly as to *Marseniopsis*, which it would be desirable to investigate further. The bearing of the new species which is the subject of this paper on the situation is, by its shell structure, to draw *Onchidiopsis* closer to *Marsenina*, partially bridging the gap and indicating in a most interesting way the precise manner in which the still whorled shell of *Marsenina* has degenerated, in this series, to the mere scale of the other species of *Onchidiopsis*.

^aThe hermaphroditism of *Velutina* rests on the bare casual mention of Bergh. So interesting a fact should be verified. The preserved material at my command has not permitted this. There is reason to suspect, as Simroth especially has suggested, that hermaphroditism among the prosobranchs may be much more frequent than commonly supposed.

^bIt is difficult to understand the high morphological significance Bergh appears to attach to this obviously plastic feature. The fold is in fact scarcely so much an anatomical character as an habitual manner of carrying the mantle border. The specimen examined by me suggests the idea that in life it might have been obliterated and re-formed at will. It can at least have no systematic importance in a phylogenetic series commencing with a shell-covered form.

As to the troublesome *Marseniopsis*, it seems closer to the Velutininae than to the Lamellariinae. The extraordinary aberrant radula of the latter is a tangible and strong point of demarcation in which no error of observation or interpretation is likely. It is an unbridged gap, and *Marseniopsis* is here wholly with the Velutininae. As to the two characters which ally it with the Lamellariinae, the expiratory cleft has already been commented on, while for an appreciation of the slight and almost technical character of the line separating androgyny from unisexuality in the gasteropods Pelseneer's paper should be consulted (Pelseneer, 1894).

Since the last of Bergh's writings on the group the Australian genus *Caledoniella* Soubervie 1869, hitherto known only from the shell,^a has been partially elucidated by Basedow [1905]. The shell is wholly internal, thin, incompletely calcified, but otherwise not very degenerate, and consists of 3 + whorls. It is strikingly naticoid in appearance. The radula has the formula 2—1—1—1—2 and in general resembles those found in the Velutininae—i. e., is naticoid. We do not know whether the animal is monœcious or diœcious. Basedow's figures do not show any expiratory cleft or fold, but in his generic diagnosis he says:—"renal aperture on the right, the mantle-border slightly grooved outward from this spot," which may indicate that the fold is present in rudimentary form. The anatomical data are insufficient for placing the genus with entire confidence, but so far as known ally it with *Marsenina* and *Ouchidiopsis* in the Velutininae, where it would lie near the base of the series. Two things, however, throw doubt on the correctness of this disposition. First, if *Marsenina* and *Ouchidiopsis* are really (as believed) derived from the naticoids through velutinoids, then it is difficult to see how *Caledoniella* can be introduced into the series, with a shell which, though more degenerate than any *Velutina*, appears to relate back direct to *Natica*. Second, *Caledoniella* is an Australian form, thus geographically suggesting alliance with the Lamellariinae, which though world-wide are especially tropical and austral, rather than with the Velutininae, which are essentially boreal. It may be suspected that if all the facts were known *Caledoniella* would be seen to be a basal term of the Lamellarioid series, its apparently greater resemblance to the Velutininae being purely negative and due to its not yet having acquired the peculiarities of dentition and generative system which mark the typical Lamellarioids. This implies that the family Lamellariidae is diphyletic, which is probably the case. But such suspicions can not be allowed to override the evidence as it stands and *Caledoniella* must for the present rest among the Velutininae.

The group considered as a whole is, at all events, a most interesting offshoot from the naticoid stem, representing evolution in the same

^a The animal described by E. A. Smith [1886] as *Lamellaria wilsoni* appears to have been in fact a *Caledoniella*, but the description is not sufficient to be of use.

direction as the nudibranchs among opisthobranchs, and the slugs among pulmonates, the direction, namely, of loss of shell. This loss apparently proceeds by a kind of combination of the methods seen in nudibranchs and slugs, for there is an embryonic "nautiloid" shell afterward shed as in nudibranchs, while the post-embryonic shell is overgrown by a notæum and degenerated as in slugs.^a It may not be wholly a coincidence that the group has developed feeding habits (on compound ascidians) recalling the nudibranchs and has become (at least in part) like them, hermaphroditic. The aberrant character of the group appears in the well-known and extraordinary "nesting" habit in a hole made in the ascidian colony and covered with an "operculum." It further appears in the sudden radical departure of one section of the group from the tænioglossate type of dentition.^b

It would seem that the best provisional treatment of the family is as follows:

Family LAMELLARIIDÆ (various family characters in nervous system, stomach, etc. Consult Bergh).

Subfamily LAMELLARIINÆ (Radula 1-1-1, of aberrant form. Sexes separate. Shell few whorled, wholly internal, but calcareous though sometimes very degenerate.^c No expiratory cleft. Nearly world-wide but especially tropical).

Genus *Lamellaria* Montagu (part), 1815 (syn. includes *Coriocella* Blainville, 1824, *Cryptothyra* Menke, 1830, *Marsenia* Leach, 1847, *Cryptocella* H. and A. Adams, 1853, *Ermea* Gray, 1857).

Subgenus *Marseniella* Bergh.

Subgenus *Chelynotus* (Swainson, 1849) Bergh.

Subfamily VELUTININÆ. (Radula 2-1-1-1-2, of naticoid form. Sexes united. Shell progressively degenerating from several whorled, external, calcareous though thin, to a mere internal horny scale. Expiratory cleft developed where shell is internal. Boreal except *Caledoniella*.)

^a May it be that the spicules of the dorid nudibranchs represent an exactly similar phenomenon? It has been generally assumed that the loss of the nautiloid embryonic shell ends the shell-history of the individual dorid and that the spicules with which the notæum is so plentifully beset represent a novel formation. The same assumption might have been made for *Onchidiopsis* were not the shell, especially in the species here described, still unmistakable as such. In other words, if we use the history of the shell in *Onchidiopsis*, which is still decipherable, as a key to read the history of the shell in the dorids, where it is not clearly decipherable, we shall conclude that the lost "nautiloid" shell is only the protoconch and shall homologize the spicules of the adult notæum with the adult internal shell of *Onchidiopsis*. There is nothing in the morphological relations of the notæum and mantle to forbid this, and it seems to the writer worthy of serious consideration.

^b The strikingly parallel aberration of the subgenus *Turritelopsis*, in the Turritelidæ, should be compared, however, as an illustration of how profoundly and suddenly the tænioglossate type of dentition may be modified without any apparent great change in the rest of the organism. Figures may be found in Tryon's Manual.

^c "Presque membraneuse." *L. leptolemma* Bergh.

Genus *Velutina* Fleming 1822.

Subgenus *Limneria* H. and A. Adams, 1853 (syn. *Mcrrillia* Gray 1857).

Subgenus *Velutella* Gray, 1847.

Genus *Caledoniella* Souverbie, 1869.

Genus *Marsenina*, Gray, 1850.

Genus *Onchidiopsis* (Beck) Bergh, 1853.

GENERA OF UNCERTAIN POSITION.

Genus *Marseniopsis* Bergh, 1886. Radula 2-1-1-1-2. Shell internal, calcareous, degenerate. Sexes separate. Strictly austral.

Genus *Lamellariopsis* Vayssi  re [1906]. Radula 2-1-1-1-2. Shell internal, calcareous, thin, paucispiral. The published "diagnosis" (quite insufficient) does not show any generic difference from *Marsenina*. Austral.

Genera *Leptonotis*, Gray, 1847; *Sc  vogyra*, Whitfield, 1877; *Lysoma*, White, 1883. Fossil.

[In addition numerous names applied to the embryonic shells—see Tryon and Bergh.]

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Although since corrected and amplified in many respects by the later researches of the author, this work of his youth remains the indispensable storehouse of original observations on the Lamellariid  , and the basis of our modern classification. Unfortunately the plates are poor and the text in Danish only. There is a "separate" issue repaged 1-119. Pages cited in text are from original pagination.

[1857.] Bidrag til en anatomisk Unders  gelse af *Marsenina* prodita (Lov  n). Naturh. For. Vid. Medd., K  benhavn, 1857, pp. 1-15, pl. 1.

[1885.] Die Marseniaden. Zoologischen Jahrb  chern, vol. 1, 1885, pp. 165-176, 1 text-fig.

This short but valuable paper was an early announcement of the author's chief generalizations from the *Challenger* material and the material from Semper's Philippine journeys. It need not, however, be consulted by the English student, as a translation has been published practically unchanged in the *Challenger* reports. See next item.

[1886.] Report on the Marseniad  . Voy. *Challenger*, Zool., vol. 15, pt. 41, 1886, pp. 1-24, pl. 1.

The first, or general part, appears to be a nearly, if not quite, literal translation of the item last above. It will be found the most satisfactory and accessible brief general account for most English readers.

BERGH, RUDOLPH—Continued.

[1886-87.] Die Marseniaden. Malacologische Untersuchungen (in Semper's Reisen nach. Philipp., vol. 2, ii), Supplement, hefte 3 and 4, 1886-87, pls. 1-11.

A great monograph of the whole family, summing up and supplementing the author's whole previous work thereon, and practically his last word on the subject—unfortunately, however, not representative of his best work. The same matter as in the last two items once more appears nearly unchanged, but forming only a small part of the whole monograph.

[1893.] Opisthobranches provenant des Campagnes du Yacht *l'Hirondelle*. Resultats des Campagnes scientifiques accomplies sur son yacht, par Albert 1^{er} Prince Souverain de Monaco, publiés sous sa Direction avec le concours du Baron Jules de Guerne chargé des Travaux Zoologiques à bord. Fascic. 4, 1893, pp. 30-32.

[1898.] Die Opisthobranchien der Sammlung Plate, Zoologischen Jahrbüchern, Supplement 4, heft 3, 1898 (Anhang, pp. 562-573, pls. 32-33).

[1899.] Nudibranches et Marsenia provenant des Campagnes de la *Princesse-Alice* (1891-1897). Resultats des Campagnes scientifiques accomplies sur son yacht, par Albert 1^{er}, Prince Souverain de Monaco, publiés sous sa direction avec le concours de M. Jules Richard, Doct. ès-sciences, chargé des Travaux Zoologiques à bord, fascic. 14, 1899, pp. 30-39, pls. 1, 2.

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[1895.] Mollusca (The Cambridge Natural History, vol. 3), pp. 1-459, Macmillan & Co., 1895.

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[1881-1887.] Manuel de Conchyliologie et de Paleontologie conchyliologique, ou Histoire naturelle des Mollusques vivants et fossiles. Paris, 1881-1887.

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[1901.] Den Norske Nordhavs-Expedition, 1876-1878, vol. 28, Zoologi, Mollusca, 3, pp. i-viii, 1-129, list of stations and map. Fol., Christiania, 1901.

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[1902.] Zoologische Ergebnisse der Russischen Expeditionen nach Spitzbergen. Mollusca and Brachiopoda 2 and 3. Ann. Mus. Zool. St. Petersburg, vol. 7, 1902, pp. 355-459, pls. 8-9.

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[1847.] Verzeichniss der Naturaliensammlung, welche auf Befehl des Königs aus verschiedenen Königlichen Musäen in Kopenhagen, so wie auch aus einigen Privatsammlungen zur 24. Versammlung Deutscher Naturforscher und Aerzte nach Kiel gesandt war. 2. Weichthiere aus der Sammlung der Herrn Dr. Kröyer. a. Von Spitzbergen. b. Von Norwegen und Dänemark. In: Amtlicher Bericht ueber die 24. Versammlung Deutscher Naturforscher und Aerzte in Kiel in September, 1846. Kiel, 1847.

In the list of mollusca from Kröyer's collection, which begins on p. 115, the species are numbered, and on that page, under the caption "*a. Von Spitzbergen*," Nos. 10 and 11 are respectively "*Coriocyella carnea* Kr.—1 (exemplar)" and "*Coriocyella recondita* Kr.—1 ditto." They are absolutely *nomina nuda*, and could only date from their habilitation by Bergh in 1853.

MÖRCH, O. A. L.

[1868.] Faunula Molluscorum Islandiæ. (Oversigt over Islands Bløddyr.) Videnskab. Meddelelser fra den naturhistoriske Forening i Kjøbenhavn for Aaret 1868, nos. 11-13, pp. 185-229. Copenhagen, 1869.

The entire volume bears date 1869 but apparently the numbers originally issued separately, and this article appeared in 1868.

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[1894.] Hermaphroditism in Mollusca. Quart. Journ. Micr. Sci., vol. 37, 1894, pp. 19-46, pls. 4-6.

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[1898.] Grönlands Brachiopoder og Bløddyr. In: Meddelelser om Grönland, udg. Comm. Ledelsen geol. og. geogr. Undersøgelser i Grönland. Heft XXIII, Afd. i, vol. 1, 1898, pp. i-xix, 1-298, pls. 1-2, Kjöbenhavn, 1898, 8°.

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[1856.] Beretning om en i Sommeren 1849 foretagen zoologisk Reise i Lofoten og Finmarken. Nyt Magazin for Naturvidensk., vol. 6, heft 2, 1850, pp. 121-211.

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[1886.] Description of a new species of *Lamellaria* from South Australia. Ann. and Mag. Nat. Hist., ser. 5, vol. 18, 1886, pp. 270-275, 1 text-fig.

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[1886.] Manual of Conchology; structural and systematic, vol. 8. Naticidæ (etc.), Philadelphia, 1886.

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[1906a.] Diagnoses generiques de Mollusques Gastéropodes nouveaux rapportés par l'Expedition antarctique du Dr. Charcot. Bull. Mus. Hist. Nat. Paris, 1906, pp. 147-149.

[1906b.] Sur les Gastéropodes Nudibranches et sur les Marséniadés de l'Expedition antarctique du Dr. Charcot. Compt. Rend. Acad. Sci. Paris, vol. 142, 1906, pp. 718-719.

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[1880.] A Manual of the Mollusca, being a treatise on recent and fossil shells. 4th ed., London, 1880.

DESCRIPTION OF PLATES.

PLATE 21.

Fig. 1. *Onchidiopsis corys*. Dorsal view; *e.*=eye; *ex. cl.*=expiratory cleft; *in. cl.*=inspiratory cleft; *l. l.*=left lobe of anterior lappet; *l. t.*=left tentacle; *r.*=rostrum; *r. l.*=right lobe of anterior lappet.

2. *Onchidiopsis corys*. Ventral view. Lettering as in fig. 1; also: *ab. e.*=abnormal eye; *m.*=mouth; *m. c.*=mantle cavity.

3. *Onchidiopsis corys*. View from right side. Lettering as in figs. 1 and 2; also: *p.*=penis; *r. t.*=right tentacle.

4. *Onchidiopsis corys*. Shell. View from right side and looking slightly from rear and above. The infolded posterior portion is seen through the anterior portion. *A.*=anterior; *D.*=dorsal; *P.*=posterior; *V.*=ventral. (In this and next two figures the shell appears too solid, being in reality a nearly colorless translucent film.)

5. *Onchidiopsis corys*. Shell. View from right side and looking from rear and below. *L.*=left; *R.*=right. Remarks as in last.

6. *Onchidiopsis corys*. Shell. View from below. Lettering and remarks as in figs. 4 and 5. (The waving of the infolded portion appears exaggerated in this figure.)

Fig. 7. *Marsenina prodita*. Shell. (This and next two figures are drawn, regardless of scale, for comparison of shell structure, forming a progressive degeneration series.)

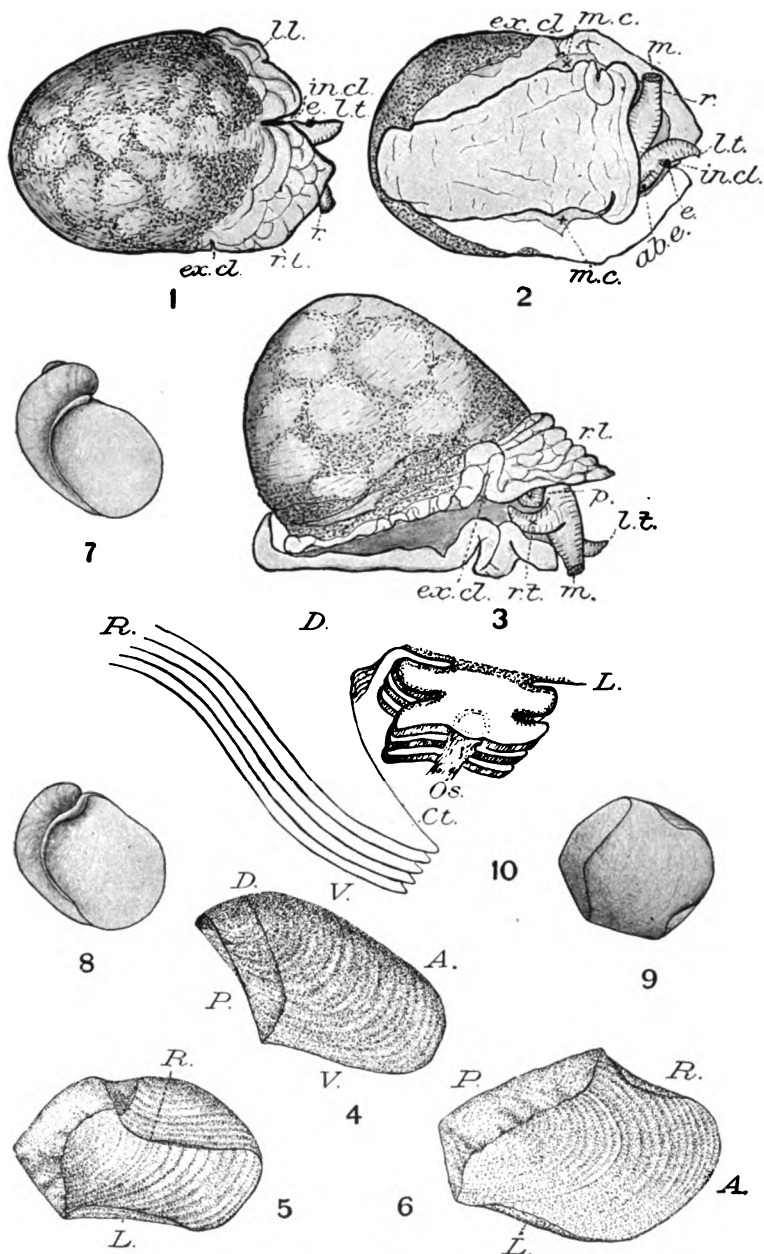
8. *Marsenina ampla*. Shell. See remarks under fig. 7.
9. *Onchidiopsis corys*. Shell, represented semidiagrammatically as a solid object, from below. See remarks under fig. 7.
10. *Onchidiopsis corys*. Osphradium and ctenidium, semidiagrammatically represented from an anterior viewpoint. *Ct.*=ctenidium; *D.*=dorsal; *L.*=left; *Os.*=osphradium; *R.*=right; *V.*=ventral. The stippling represents the black-pigmented areas on the roof of the gill cavity and basal surfaces of the lobes of the osphradial leaflets.

PLATE 22.

Fig. 1. *Onchidiopsis corys*. Dorsal view of head region. Notæum is slightly slit up from inspiratory cleft and the lobes of the anterior lappet turned back. *ab. e.*=abnormal eye; *ab. t.*=abnormal (external) branch of the bifid left tentacle; *b.*=foot; *e.*=eye; *f.*=auricle of foot; *g. c.*=opening of gill cavity; *l. l.*=left lobe of anterior lappet; *l. t.*=left tentacle; *p. bas.*=penis, basal portion; *p. cr.*=penis, crest; *r.*=rostrum; *r. l.*=right lobe of anterior lappet; *r. t.*=right tentacle.

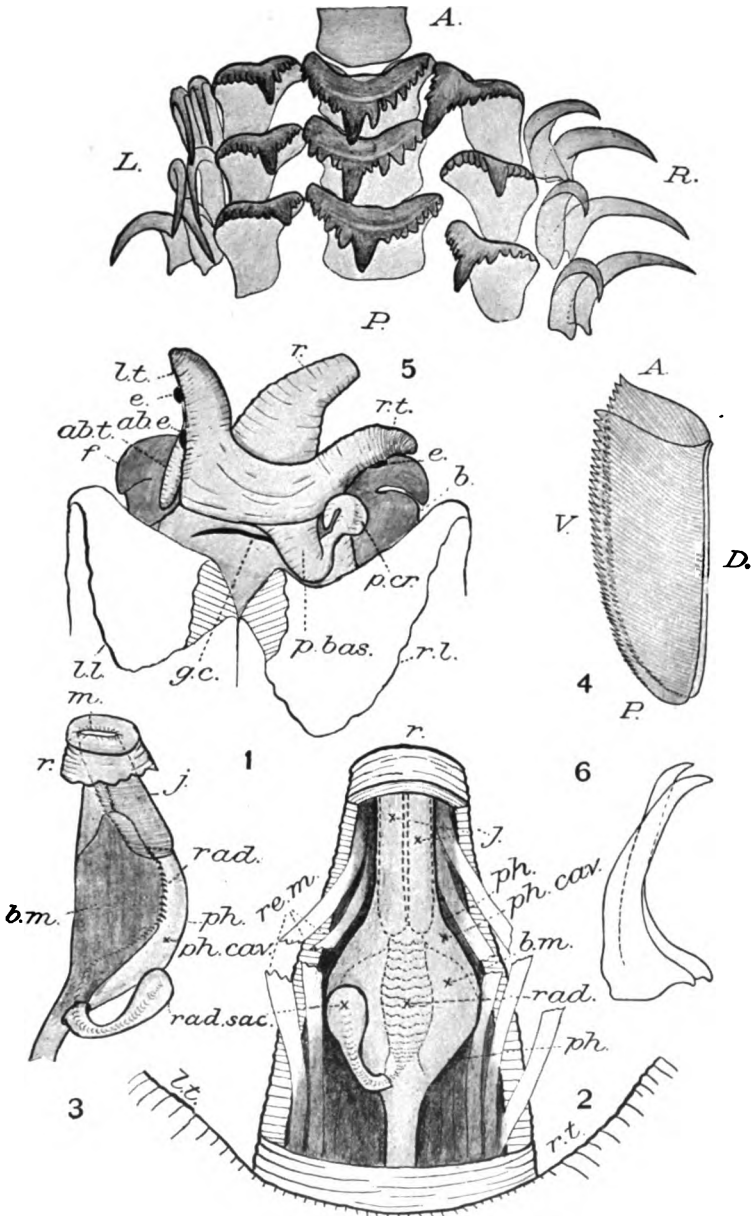
2. Dissection of rostrum. Dorsal view. *b. m.*=buccal mass; *j.*=jaws; *l. t.*=left tentacle; *ph.*=wall of pharynx; *ph. cav.*=pharyngeal cavity; *r.*=rostrum; *rad.*=radula; *rad. sac.*=radula sac; *re. m.*=retractor muscles; *r. t.*=right tentacle. (The walls of the dorsal half of the rostrum are represented as cleanly cut away except at the tip, which is intact. The retractor muscle bundles, which line it, are only partially shown, and some are represented as broken and pushed aside to allow a view of the pharynx. The thin-walled pharynx is represented as partially transparent, and through it, represented in dotted lines, are seen the jaws and the buccal mass, the latter containing the greater portion of the radula. On top of the pharynx and to the left lies the radula sac, a prolongation of the buccal mass the neck of which pierces the pharynx wall. The radula is shown as if the radula sac and buccal mass were semitransparent.)
3. Semidiagrammatic view of rostrum from left side. The wall of the rostrum is supposed to be wholly removed except at the tip, where it is intact. As in the last figure, the jaws and buccal mass are represented as seen through the thin-walled pharynx, and the radula as if seen inside the buccal mass and radula sac; but in this figure their lines are not dotted. Lettering as in last; also, *m.*=mouth.
4. Jaws, seen from left side. *A.*=anterior; *D.*=dorsal; *P.*=posterior; *V.*=ventral.
5. Radula. Dorsal view of three rows from near broadest point (about ten rows from anterior end). Camera lucida drawing. \times oc. 1, obj. 3.
6. Radula. Two uncinial hooks from right side. Camera lucida drawing. \times oc. 1, obj. 7.

Plate 21, figures 1, 2, 3, and 10, and Plate 22, all figures, were drawn by the author from the specimen. Plate 21, figures 4, 5, and 6, were, drawn by Mr. Sergius Morgulis, from the specimen. Plate 21, figures 7 and 8, are copied from figures reproduced in Tryon's Manual of Conchology.



A NEW LABRADOREAN SPECIES OF ONCHIDIOPSIS.

FOR EXPLANATION OF PLATE SEE PAGE 483.



A NEW LABRADOREAN SPECIES OF ONCHIDIOPSIS.

FOR EXPLANATION OF PLATE SEE PAGES 483 AND 484.

LEIDYOSUCHUS STERNBERGII, A NEW SPECIES OF CROCODILE FROM THE CERATOPS BEDS OF WYOMING.

By CHARLES W. GILMORE,

Custodian of Fossil Reptiles, U. S. National Museum.

The Division of Vertebrate Paleontology of the U. S. National Museum has recently acquired from Mr. C. H. Sternberg, of Lawrence, Kansas, an unusually well-preserved crocodilian skull and jaws associated with other parts of the skeleton. The specimen was found by his son, Mr. Charles M. Sternberg, on the north side of the Cheyenne River, in the Ceratops Beds of Converse County, Wyoming, during the summer of 1909.

Although there is abundant evidence of the existence of crocodiles in these beds, well-preserved specimens are exceedingly rare. Such fragmentary remains as have been found from time to time paleontologists have usually referred to *Crocodylus humilis* Leidy, a Judith River species founded upon insufficient evidence, and as Hatcher^a has pointed out, "the simple conical teeth upon which the species was based furnish no characters for the positive identification of other material."

The specimen considered here, I refer to the recently established genus *Leidyosuchus* of Lambe,^b which is founded upon specimens from the Judith River Beds (Belly River) of Alberta, Canada. Even though it occurs in a geological horizon of considerably later age, no characters were detected which would justify more than its specific separation from *Leidyosuchus canadensis* Lambe, and I therefore take great pleasure in naming the species after the veteran collector, Mr. C. H. Sternberg, whose devotion to paleontology has done so much to further that science.

^a Bull. No. 257, U. S. Geol. Surv., 1905, p. 82.

^b Trans. Royal Soc. Canada, vol. 1, 1908, pp. 219-244.

LEIDYOSUCHUS STERNBERGII, new species.

Pls. 23, 24, 25, 26, and 27.

Holotype.—Cat. No. 6533, U.S.N.M., consists of the greater portion of the skull, the left ramus almost entire, anterior part of the right ramus, eight vertebrae in various stages of preservation, both humeri, right fibula, second metatarsal of the left hind foot, and other fragmentary parts of the skeleton.

Type-locality.—North side of Cheyenne River, about 3 miles west of McKeow's ranch, Converse County, Wyoming.

Horizon.—Ceratops Beds, Cretaceous.

Detailed description.—Viewed from above the form of the skull resembles that of the living crocodile, although compared with *Crocodylus americanus* it is proportionally broader posteriorly, approaching nearer in its general outline the skull of *C. porosus*. Evidently the specimen is that of an adult as shown by the complete coalescence of many of the sutures. A section across the whole width of the median preorbital region and extending back on the right posterior half of this aspect has been lost through erosion. In Pl. 23 is shown a superior view of the skull, reproduced here from a photograph taken after the missing portions were restored. The lighter color of the restored parts distinguishes them at once from the original fossil.

The coalesced parietals occupy the posterior median position, their anterior lateral borders forming the inner boundaries of the supratemporal fossæ. The least width of the parietals between these vacuities is 17 mm. The posterior half of the dorsal surfaces of the parietals is covered with large, deep, irregularly shaped pits, while on that portion between the fossæ there is a single median longitudinal ridge with comparatively smooth tracts on either side which extend laterally to a smooth, raised ridge of bone around the inner and posterior boundaries of the supratemporal vacuities. The suture between the parietal and squamosal of the left side can not be distinguished, but as shown in *L. canadensis* their union is probably at the middle of the posterior boundary of the supratemporal fossa.

The union of the parietals with the frontal is only dimly discernible, but on the inner anterior surface of the left supratemporal fossa the suture is quite distinct and shows clearly that the frontals contribute to the boundary of the fossa on the superior surface between the parietal and postfrontal, as in *Diplocynodon* Pomel. Two detached but broken parts of the frontal bone, which were found near this specimen and which supplement each other, may, from their size and sculpturing, be considered as belonging to the present species, and shows that this bone was broad behind and narrow in front. In the type skull the side of the frontal is excavated for a distance of

18 mm. by the inner border of the orbit. The posterior upper surface is ornamented with well-defined pits, smaller than those found on the same surface of the parietals. These pits vary in size and shape from subround to elongate-oval, being arranged in transverse rows and separated by ridges narrower than themselves; none are confluent. The larger pits have their greatest diameter transversely. The median anterior portion is without decided ornamentation, as best shown in a detached frontal (Cat. No. 6542, U.S.N.M.). The whole of the under surface is smooth except an area on either side posteriorly for the sutural union with the alisphenoids, where it forms a considerable part of the roof of the cranial cavity. Between the alisphenoids is a median longitudinal depression, which carries the sense organs to the olfactory lobes of the brain. This groove traverses the whole length of the bone, widening anteriorly to the fronto-prefrontal suture. Posteriorly, this suture can only be made out on the inner orbital surface where it occupies approximately the same position as in *C. americanus*, and on the orbital side runs obliquely downward and forward.

The squamosal meets the quadrate and exoccipital below and forms part of the roof of the external auditory meatus. It is pitted above, and, with the prefrontal, forms the outer boundary of the supratemporal fossa. The postfrontal unites as usual with the jugal by a strong postorbital bar. The shape or extent of the nasals, prefrontals, or lachrymals can not be determined in this specimen, as all of the sutures are obscure. These bones are roughly sculptured. That portion of the preorbital region which is preserved in this specimen is depressed medially and at the sides is bent sharply downward and inward to the alveolar border; more anteriorly the direction of the side is only downward. As a whole, the snout is bent somewhat upward, so that in profile the anterior portion is slightly concave above. (See Pl. 25.) The cranium above and extending down the sides on the jugal, maxillary, and premaxillary bones is beautifully sculptured with pits of irregular size and shape, inclosed by reticular ridges of varying widths. The sculpturing is most rugose on the posterior elements, particularly on the jugal and posterior half of the maxillary; medially on the nasals, are long, broken, longitudinal grooves, while on the muzzle the pitting as a rule is finer and more shallow, and lacks the definition of the posterior surfaces.

Over the aveoli for the ninth and tenth teeth, the lateral borders of the maxillæ are swollen outwardly, but anteriorly the muzzle gradually contracts to the elongated notch which receives the lower canines, this being the narrowest part of the skull, measuring 50 mm. in transverse diameter. In advance of the notch the premaxillæ swell out into a moderately broad but evenly rounded nose. The widest part, over the fourth premaxillary teeth, measures 58 mm.

The premaxillæ inclose the heart-shaped external nares, but it can not be determined from this specimen whether or not the nasals extended into this opening. In *Diplocynodon hautoniensis* (Wood), which Owen figures in his monograph^a under the name *Crocodylus hastingsiæ*, the nasals do not reach the narial opening, and taking into account the many other resemblances it may be that the same condition prevails in the nasals of *Leidyosuchus*. Lambe, from incomplete evidence, was inclined to believe the nasals reached a point in advance of the maxillaries in *L. canadensis*, and if his observation be correct, they at least approach the nares more closely than in *Diplocynodon*.

The posterior extent of the facial processes of the premaxillæ can not be determined, although the maxillo-premaxillary and maxillo-nasal sutures can be traced (see Pl. 23) back as far as the missing facial section previously mentioned. Latero-inferiorly the posterior boundary of the premaxillary is at the back of the notch behind the fifth tooth, where the maxillo-premaxillary suture passes on to the palate.

The supratemporal fossæ are of good size and subelliptical in shape, measuring 33 mm. longitudinally and 23 mm. transversely. The orbit communicates with the infratemporal fossa. The latter are slightly smaller than the supratemporal fossæ and angularly rounded. The left fossa, the borders of which are nearly intact, measures about 25 mm. both transversely and antero-posteriorly.

The orbits are large and look upward and forward, with their inner borders everted as in the alligator. The greatest longitudinal diameter of the left orbit is 55 mm. and the transverse diameter 38 mm.

The inferior or palatal surface is more complete than the dorsal, lacking only the posterior ends of the palatines, the right pterygoid, transpalatine, and posterior half of maxillary of same side. The anterior palatal region is decidedly concave transversely, and between those elements which have not suffered mutilation all of the sutures are plainly distinguishable. The palatine processes of the premaxillæ reach the level of the aveolus for the first maxillary tooth, the posterior ends being rounded. In this view the premaxillæ inclose a small rounded anterior palatine vacuity which measures 12 mm. longitudinally and 13 mm. transversely.

The anterior processes of the maxillæ extend forward on the median line to the level of the middle of the notch which separates the maxillary and premaxillary dental series.

The palatines meet the maxillæ at the center by a nearly straight transverse suture opposite the tenth maxillary tooth. The median posterior processes of the maxillæ extend back on the sides of the palatines to a point opposite the thirteenth maxillary tooth. The palatines are narrow and at the middle of the posterior palatine

^a Monograph of the fossil Reptilia of the London Clay, pt. 2, 1850, pp. 42-44, pl. 6, fig. 7.

vacuity measure only 23 mm. in transverse diameter. Their sutural union with the pterygoids, owing to the damaged condition of this part of the palate, can not be determined.

The posterior palatine vacuities are comparatively large, measuring 101 mm. longitudinally and 34 mm. transversely. The anterior border of these vacuities is opposite the twelfth maxillary tooth, as in *Diplocynodon*.

The pterygoid of the left side is practically entire and has suffered no distortion. It extends downward and backward from the general level of the palate at an angle of 45°. The postpalatal vacuities encroach but little on the pterygoids. The preservation of the back border of the posterior aperture of the nasal passages is sufficient to establish its position as being wholly surrounded by the pterygoids. There is a bridge of bone 12 mm. wide separating this opening from the posterior median border of the pterygoids which leads down to the median Eustachian foramen. (See Pl. 24.) In all modern crocodiles these two openings are separated by only a thin septum of bone. In this respect *L. sternbergii* from the Cretaceous is intermediate between those early Triassic and Jurassic forms having the posterior narial opening well forward on the palate, and the Tertiary crocodiles where it has receded posteriorly to a position nearly, if not quite, as far as in modern crocodilians. The posterior border of the conjoined pterygoids is notched, the notch being the interval between two thin diverging processes from the back part of the pterygoids. The form of the posterior nares can not be determined from this individual.

The transpalatines connect the pterygoids with the maxilla, as shown in Pl. 24.

In the posterior view of the skull (Pl. 26) hardly any of the sutures can now be distinguished, and a comparison of this aspect with the excellent figures given by Lambe of *Leidyosuchus canadensis*, only serves to give one an approximate idea of the relations of the several elements comprising the occiput. In the proportion of its breadth to its depth, *L. sternbergii* differs from *L. canadensis* in the considerably less vertical extent of the coalesced elements overlying the foramen magnum, in the shortness vertically of the descending part of the basioccipital, and in the comparative lightness, both horizontally and vertically, of the condyle of the quadrate. In the latter respect it approaches *Diplocynodon haultoniensis* of the London Clay.

The basioccipital is deeper than broad, and viewed from behind almost hides the basisphenoid which lies in front of it. Between these two bones at their lower extremities is the opening for the median eustachian canal. (See *m. e. c.*, Pl. 26.) Below the occipital condyle on the median posterior surface of the basioccipital a prominent sharp vertical keel is developed which is even more pro-

nounced than that found in the living alligators. Another alligator-like character is seen in the entire exclusion from this view of the posterior nostril, due to its position below the opening of the eustachian canal and in advance of the posterior border of the pterygoids, from which it is partitioned off by a strong bridge of bone 12 mm. wide.

The exoccipital is pierced by four foramina. Of these, three are close together a little above the floor of the foramen magnum Pl. 26. Beginning with the most posterior, they are (XII) foramen for the exit of the hypoglossal nerve (X) foramen for the pneumogastric, and (VII) the largest of the three, which gives passage to the facial nerve and certain blood vessels. Below these, near the lower extremity of the exoccipital, is the large foramen through which the internal carotid artery enters the skull.

The external auditory meatus leading into the tympanic cavity occupies the usual position deep in under the squamosals, and compared with the same opening in *Crocodylus americanus* no essential differences are apparent. Leading back from the tympanic cavity is a canal in the quadrate through which the cartilaginous rod passes, and during life is continuous with Meckel's cartilage within the articular bone of the mandible.

Viewed from the side, the occiput above the level of the floor of the foramen magnum is inclined decidedly forward up to the parietal, and the part below this level inclined forward to a somewhat greater extent in passing down to the lower extremity of the basisphenoid, which continues below the basioccipital to meet the conjoined pterygoids.

On account of the damaged condition of the brain case, the elements comprising it can not be differentiated, although all the important foramina can be located. Taken in order from back to front they are: *Foramen ovali* for the trigeminal nerve; the pair of foramina lying beneath the pituitary fossa which furnish passage for the carotid arteries; and the large anterior foramen for the exit of the olfactory nerves. In all essentials the relationships of the several foramina are very similar to those found in the skull of extant crocodilians.

The teeth.—The dental formula of *Leidyosuchus sternbergii* is $\frac{24-24}{21-21}=90$. In the type-specimen we are fortunate in having fourteen teeth in the upper and three in the lower mandible in a good state of preservation, in addition to the crowns of three others found detached.

The teeth *in situ* are distributed as follows: First of the left premaxillary; fourth, sixth, seventh (germ tooth), eighth, twelfth, thirteenth, fifteenth (germ tooth), seventeenth, and eighteenth of the left maxillary; fourth (germ tooth), seventh, eighth, and ninth

of the right maxillary. In the left ramus of the lower mandible are the fourth and seventeenth, with the base of the twelfth and in the portion of the right ramus is the base of the third and a young tooth in the eighth alveolus. Taken in the order mentioned above, the crowns of the teeth give the following measurements in millimeters, the first of each pair of numbers being the height; the second, the basal or antero-posterior extent: First, 4.5—3.5; fourth, 9 (tip broken off)—7.5; sixth, 6—5; eighth, 4.8—4; twelfth, 6—6; thirteenth, 5—5.7; seventeenth, 3.2—4.7; eighteenth, 2.5—4.5. Right side, seventh, 5—4.1; eighth, 5.1—4.5; ninth, 5—5.6.

Most of the teeth, excepting those enlarged, are much the same shape, with short, compressed subacute or obtuse crowns. The crown bears on each side a distinct, sharp-edged ridge placed a little toward its inner face, and unworn crowns extending from the apex to near the base. These ridges or carina define laterally, on the shorter teeth of the series, an area on the inner surface that is less convex and slightly less in breadth than the outer surface. In most of the enlarged teeth these ridges are placed nearer together and define an area on the inner side, the breadth of which slightly exceeds one-third the circumference of the tooth. The crowns of all the smaller teeth are separated from the fang by a slight constriction or neck.

The larger teeth in cross section are more rounded and proportionally narrower transversely than the smaller, but somewhat more curved. A scrutiny of the measurements given above shows that the crowns of the posterior teeth are greater in width than in height, while in advance of the twelfth maxillary tooth the height is greater.

The anterior pair of premaxillary teeth are close together, being separated on the median line by a narrow slit, which emerges dorsally into an enlarged rounded foramen. The one preserved tooth of this pair is small and comparatively slender. The first pair is separated from the alveoli of the second pair by deep pits for the reception of the anterior mandibular teeth, which do not perforate the upper surface as in some extinct and all modern crocodiles. The second pair are small and in close contact with the alveoli for the third pair, which are much enlarged. The fourth pair appear to be a trifle larger than the third, from which they are separated on the inner side by a pit. The fifth and last pair in the premaxillaries are very small and in close contact with the fourth.

Between the fifth pair of the premaxillaries and the first of the maxillaries are elongated notches (anterio-posteriorly they measure 15 mm.) which receive the two enlarged teeth of the mandibular series.

The first three maxillary alveoli are rather small, though they increase in size from front to back. The fourth and fifth are much enlarged, and, judging from the size of the alveolus, the fourth is the

most robust tooth of the upper dental series. The sixth, seventh, eighth, and ninth are much reduced in size, but the tenth and eleventh alveoli appear to have carried larger teeth. From this point, however, to the end of the series, the teeth gradually diminish in size toward the back. In the lower mandibular series all of the alveoli and three of the teeth are preserved. The front teeth of the symphyseal region, that is, the first to the fourth, were directed obliquely outward. This peculiarity is somewhat manifest as far back as the eleventh of the series, back of which an upright position is maintained. The dental series of the anterior half passes in a curve from the outer to the inner side of the dentary. The fourth tooth was probably the largest of the lower series, although, judging from the alveoli, the third must have been approximately the same size. The fifth to the tenth were small. The eleventh, twelfth, and thirteenth were slightly and about equally enlarged, and those posterior to the thirteenth gradually decrease in size.

Comparative measurements of skulls.

	Holotype of <i>Leidyosuchus</i> <i>sternbergii</i> .	Paratype of <i>Leidyosuchus</i> <i>canadensis</i> .
	mm.	mm.
Width between outer edges of quadrates, posteriorly.....	183	201
Height of occiput, in median line, from upper surface of parietal to anterior edge of opening of median eustachian canal.....	61	90
Height of foramen eustachian canal.....	13	14
Width of foramen magnum.....	16	17
Height of basioccipital, in median line.....	37.5	42.5
Breadth of basioccipital at midheight.....	37	39
Breadth of condyle of quadrate.....	30	39
Height of condyle of quadrate at center.....	11	15
Breadth of the upper surface of parietal, posteriorly.....	• 40	43
Length of upper surface of parietal, in median line.....	• 40	38
Distance of posterior end of preserved surface of nasal passage to anterior edge of opening of median eustachian canal.....	12	16

• Estimated.

Mandible.—The parts preserved of the lower jaw consist of the left ramus almost entire, lacking only the coronoid and portions of the articular, and the anterior portion of the right ramus as far back as the alveolus for the eleventh tooth.

The mandibular symphysis is short and composed of the splenial and dentary. In *Leidyosuchus canadensis* the splenial participation in the symphysis is about one-fifth of its total length, while in *L. sternbergii* it is somewhat less. In this particular, among American brevirostrate crocodiles, *Leidyosuchus* is approached by *Crocodylus polyodon* of the Wasatch and *Bottosaurus* from the Cretaceous of New Jersey, in the latter the splenial reaches the symphysis without contributing to it.

On the dorsal border of the left ramus, alveoli for twenty-one teeth can be clearly distinguished.

By referring to the table of measurements it will be observed that the dimensions of the ramus of the specimen under consideration are almost identical with those of the holotype of *L. canadensis*.

Viewed from the side the alveolar border is undulating, while the lower side from a point just posterior to the external mandibular foramen presents a nearly straight border to the upturn of its extremity near the symphysial end. The external mandibular foramen is relatively large and in outline has the form of an elongated ellipse. (See *e. m. f.*, Pl. 25.)

The internal mandibular foramen is relatively small, and in relation to the large external foramen is located more posteriorly than in living crocodilians. The position of this foramen is well shown in Pl. 27 (*i. m. f.*).

In the region of the eighth tooth the dentary is constricted, but anteriorly it widens both inward and outward, reaching its maximum breadth in line with the fourth tooth, with a transverse diameter of 32 mm. Posterior to the constriction the alveolar border ascends rapidly to the position of the twelfth tooth. From this point posteriorly the upper border rises gradually with a gentle concave curve, thus adding considerably to the depth of the jaw. The maximum depth of the ramus is just posterior to the external mandibular foramen, where it reaches 53 mm.

The dentary articulates in the usual manner with the surangular above and the angular below. The upper posterior prolongation of the dentary, however, does not extend so far back over the external foramen as in living crocodiles. The anterior extension of the angular is received between the dentary and splenial, terminating under the alveolus for the nineteenth tooth. The external surfaces of both the angular and surangular, especially the former, are roughly sculptured (well shown in Pl. 25). The irregular pitting of the upper half of the external surface of the angular is succeeded below by long, somewhat irregular grooves and ridges which conform to the curves of the lower margin of the jaw. The dentary along the whole of its outer and under surface is pitted by numerous vascular openings leading obliquely forward into the interior of the bone. These openings become more numerous anteriorly, and on the lower part the surface is roughened by numerous longitudinal grooves.

The splenial covers the whole inside of the ramus back to the internal mandibular foramen. Just behind the symphysial union, the splenial is pierced by a small, longitudinally elongated foramen which leads into the meckelian groove. Lambe has shown^a that beneath this opening there is a small foramen in the dentary leading into the dental canal. Unlike the type of *L. canadensis*, the bony

^a Trans. Royal Soc. Canada, vol. 1, 1898, pp. 223-224.

divisions of the alveoli form distinct sockets for the teeth and furnish additional evidence of the mature age of this individual.

The coronoid is missing.

The articular is somewhat damaged but the parts remaining show no unusual characters.

Comparative measurements of rami.

	Holotype of <i>Leidyosuchus</i> <i>sternbergi</i> .	Holotype of <i>Leidyosuchus</i> <i>canadensis</i> .
	mm.	mm.
Length of ramus.....	380	335
Breadth of ramus through center of alveolus of fourth tooth.....	31	31
Height of symphysis in line with alveolus of fourth tooth.....	19	18
Length of symphysis.....	56	57
Length of splenial contribution to symphysis.....	7.5	11.5
Length of postsymphysial foramen.....	6	7.5
Height of postsymphysial foramen.....	3	3.2
Height of splenial behind postsymphysial foramen.....	16	16
Breadth of dentary at alveolus for eighth tooth.....	11	18
Height of dentary in line with same alveolus.....	18	17.5
Height of ramus at posterior end of external mandibular foramen.....	53	53
Thickness of angular a little above lower border where last measurement was taken.....	16	16
Thickness of surangular at upper border where last measurement was taken.....	7	8.5
Length occupied by alveoli from fourth to eighteenth tooth.....	123	128

• Estimated.

Vertebrae.—Of the vertebral column of this specimen there are preserved the left neurapophysis of the atlas, four dorsal, two lumbar, and one sacral (second) vertebrae. All of those present are of the procoelian type.

The neurapophysis, when compared with the homologous part in *Crocodylus americanus*, shows the anterior process to be a little longer and wider vertically, and the constriction above the articular end forming a somewhat deeper notch on the forward side.

The dorsals show the typical cup and ball articulation. The centra have the sides concave antero-posteriorly, with the least transverse diameter toward the posterior end. In all of the dorsals preserved the inferior surface is evenly rounded. In this respect they differ from those of *Leidyosuchus canadensis*, which are described as being flat in this aspect. The centra increase in breadth below the neuro-central suture. The neural arches inclose the neural canal which is slightly higher than wide. The arches of these vertebrae are firmly coossified with the centra, which furnishes additional evidence of the mature age of the individual. Two of the dorsal centra show shallow longitudinal depressions on the mid-lateral surfaces. None of the spinous processes are complete though the broken bases show them to have been broad antero-posteriorly. The transverse processes are given off well up on the sides of the arches. The most anterior dorsal,

corresponding perhaps to the eighth in recent crocodiles, shows the same step-like facets with which the tubercula of the ribs articulate.

As Lambe has pointed out, the anterior zygapophyses together with the bases of the transverse processes form an undulating platform of considerable extent. The more nearly horizontal position of these zygapophyses would appear to distinguish the vertebræ from those of *L. canadensis*.

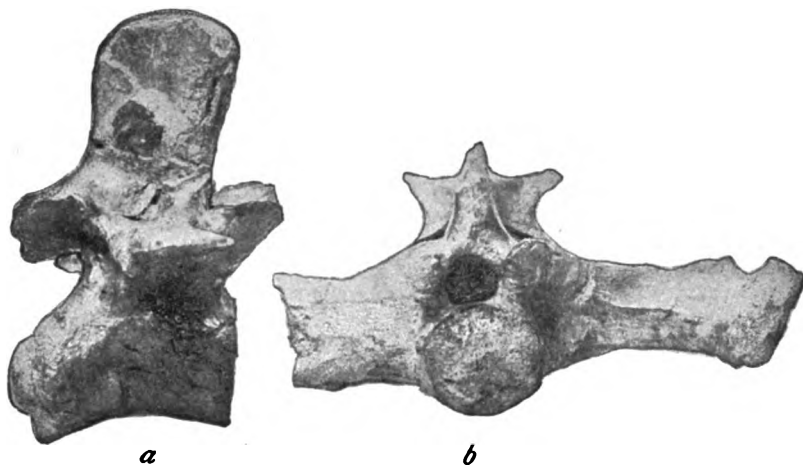


FIG. 1.—LEIDYOSUCHUS STERNBERGII. a, FOURTH (?) LUMBAR VERTEBRA, SEEN FROM RIGHT SIDE; b, SECOND SACRAL VERTEBRA, SEEN FROM FRONT. BOTH FIGURES NATURAL SIZE.

Measurements of dorsal vertebræ of Leidyosuchus sternbergii.

	I.	II.	III.	IV.
	mm.	mm.	mm.	mm.
Greatest length of centra.....	30	30	33	34
Greatest transverse diameter, anterior end.....	19	20	20	20
Greatest vertical diameter, anterior end.....	19	19	18.5	19
Greatest transverse diameter, posterior end.....	17	17	19	20
Greatest vertical diameter, posterior end.....	17	16	16	16
Greatest antero-posterior extent of left transverse.....	19			
Greatest length of left transverse from median line.....	48			

The two lumbar vertebræ are probably the third and fourth of the series. Their centra differ from the dorsals in being more broadly rounded inferiorly and having their least transverse diameter nearer the middle. The neural canal is more nearly circular, and the transverse processes are narrower and spring from the sides of the arch at a lower level than in the dorsals, thus leaving the anterior zygapophyses standing out alone and well above them. The spinous processes rise above the middle of the centrum as a broad, thin plate with a truncated upper extremity (see a, fig. 1).

Measurements of lumbar vertebra of Leidyosuchus sternbergii.

	Third.	Fourth.
Greatest length of centra.....	30	30
Greatest transverse diameter, anterior end.....	20.5	21
Greatest vertical diameter, anterior end.....	18.5	18
Greatest transverse diameter, posterior end.....	20	20
Greatest vertical diameter, posterior end.....	16.5	17
Greatest antero-posterior extent of transverse.....	13	9.5
Greatest length of right transverse process from median line.....		37
Greatest width (antero-posteriorly) spinous process near top.....		30
Greatest width between outer edges of prezygapophyses.....		35

The concave, convex, articulating ends of the second sacral are much less pronounced than in the presacrals described above. The inferior surface is broad and only slightly rounded; the sacral ribs are heavy and firmly ankylosed with the whole side of the centrum and half way up on the neural arch. In size and general shape it agrees in all essentials with the sacral figured by Lambe,^a except in this species the neural canal is circular instead of being elongated vertically as in *Leidyosuchus canadensis*. (See *b*, fig. 1.)

Measurements of second sacral vertebra of Leidyosuchus sternbergii.

	mm.
Greatest length of centrum.....	27.5
Greatest transverse diameter, anterior end.....	16
Greatest transverse diameter, posterior end.....	17
Greatest transverse diameter from middle of centrum to end of sacral rib.....	41
Greatest width between outer edges of postzygapophyses.....	23

Limb and foot bones.—The few bones of the limbs found with the type skull show that the proportional lengths of the fore and hind limbs in *Leidyosuchus* are approximately the same as in modern crocodiles, although the humeri, when compared with those of a specimen of *Crocodylus americanus* of the same size, are relatively more slender.

The general characteristics of these bones are well shown in fig. 2 and their principal dimensions are given in the table of measurements below.

Measurement of limb and foot bones of Leidyosuchus sternbergii.

	mm.
Greatest length of right humerus.....	164
Greatest width of proximal end of humerus.....	34
Greatest length of fibula.....	140
Greatest width of proximal end of fibula.....	27
Greatest width of distal end of fibula.....	25
Greatest length of metatarsal.....	84
Greatest width of proximal end of metatarsal.....	20
Greatest width of distal end of metatarsal.....	10

^a See Trans. Royal Soc. of Canada, vol. 1, art. 16, pl. 4, fig. 13, 1908.

Scutes.—There were no scutes found with the holotype of *L. sternbergii*, but in a small collection of fossils made by Mr. A. L. Beekly from the Ceratops Beds (or their equivalent) on the Standing Rock Indian Reservation, of South Dakota, were two dermal scutes (Cat. No. 6545, U.S.N.M.) of a crocodilian, which correspond closely in all respects to those figured by Lambe. These were associated with detached teeth which can not be distinguished from those of *Leidyosuchus*, and the range of this genus is thus extended into South Dakota. These remains were associated with a typical Ceratops



FIG. 2.—*LEIDYOSUCHUS STERNBERGII*. *a*, LEFT HUMERUS, VENTRAL VIEW; *b*, RIGHT HUMERUS, DORSAL VIEW; *c*, RIGHT FIBULA, LATERAL VIEW; *d*, SECOND METATARSAL OF LEFT HIND FOOT; *e*, PROXIMAL HALF OF A METATARSAL. ALL FIGURES HALF NATURAL SIZE.

Beds fauna, the following forms having been recognized. *Triceratops*, *Trachodon*, *Champsosaurus*, *Basilemys*, and *Lepidosteus*.

NOTES ON A CROCODILE FROM THE HELL CREEK BEDS OF MONTANA.

Since the preceding pages were written a second specimen (Pls. 28 and 29) belonging to this species from the vertebrate paleontological collection of the American Museum of Natural History has been received. It bears the catalogue number 5898 and consists of the greater portion of the cranium, lacking only the lower part of the occiput, left quadrate, and posterior portions of the pterygoids. The skull was collected from the Hell Creek Beds, on Gilbert Creek,

Dawson County, 135 miles northwest of Miles City, Montana, by Mr. Barnum Brown, through whose courtesy I am now permitted to describe it.

The specimen is that of an adult individual of slightly larger size than the type of the species. Like the latter, however, nearly all the sutures of the facial portion of the skull are obliterated and we must await the discovery of other material before the relative relationships of these elements can be determined.

Compared with the type of the species, it differs in the greater breadth of the muzzle, the larger size of the teeth, the flatness of the facial region without the upturn of the premaxillary part, and the uniform coarseness of the sculpturing of the superior aspect. At first I was inclined to believe the differences enumerated were sufficient to justify the establishment of a new species, but after a careful study of a series of recent crocodile and alligator crania, and noting the occurrence of essentially the same differences in skulls of individuals collected from the same region, and undoubtedly belonging to the same species, there appeared no warrant for so doing. Such characters as have been mentioned can all be accounted for, in recent forms, by individual variation due in most part to differences in age, and it would appear reasonable to suppose these observations would also apply to the fossil members of this group.

The dental formula of the cranium is the same as in the type—that is, five premaxillary and nineteen maxillary teeth. The ends of the premaxillary processes on the palate are more broadly rounded than in the type.

The difference in the contour of the muzzles of the two skulls is apparently due to the difference in age of the two specimens, the latter, as shown by its larger size and complete obliteration of most of the sutures, being considered the more mature.

In this individual the palatines are complete, though their line of union with the pterygoids can not be made out. Those parts of the pterygoids still attached to the posterior ends of the palatines (shown in Pl. 29) are most important as giving the shape and position of the posterior nares. This aperture in *Leidyosuchus* appears to have been wholly surrounded by the horizontal plate of the pterygoids. In outline (see *p. n.* fig. 29) it may best be described as heart-shaped with the apex directed backward. While it resembles the posterior nares in *Diplocynodon* as figured by Owen,^a its position, as would be expected from their relative geological positions, is considerably more forward on the palate. Measured from a line drawn transversely across the back borders of the posterior palatine vacuities, the anterior border of the nares is 14 mm. posterior to it.

^a Monograph of the fossil Reptilia of the London Clay, pt. 2, 1850, pl. 7, fig. 2.

Though the evidence is not entirely conclusive, it would appear from the occurrence of an open median suture at the posterior border of the external nares, that the nasals did not reach the narial opening.

That the skulls discussed in the preceding pages do not represent the largest individuals of this genus is shown by an incomplete mandible (Cat. No. 984, American Museum of Natural History) whose total length from the tip to the broken end below the middle of the articular portion of the articular bone measures 403 mm. The same measurement taken from the left ramus of the type of *L. sternbergii* is 343 mm.

The alveolar border of the dentary shows alveoli for twenty-one teeth as in the type of the species mentioned above. The sculpturing is somewhat coarser, but this is probably an age characteristic. The splenial, as in the other specimens, enters the symphysis, but the extent of its contribution can not be accurately determined.

The ramus was collected by Mr. Barnum Brown near the top of the Hell Creek Beds, 350 feet above the Pierre, 16 miles north of Jordan ^a and about 135 miles northwest of Miles City, Montana.

Measurements of skulls of Leidyosuchus sternbergii.

	Cat. No. 6533 U. S. N. M.	Cat. No. 5898 Am. Mus. Nat. Hist.
	mm.	mm.
Length of skull on median line.....	303	319
Length of skull in front of orbits.....	200	204
Transverse diameter of skull, outer angles of quadrates.....	184	216
Transverse diameter of skull, front of orbits.....	132	131
Transverse diameter of snout across level of tenth tooth.....	77	95
Transverse diameter of snout across premaxillaries.....	58	72
Least transverse diameter of snout at notch.....	50	63
Longitudinal diameter, orbital opening.....	55	58
Transverse diameter, orbital opening.....	38	37

Genus LEIDYOSUCHUS.

The genus *Leidyosuchus* was founded ^b by Lambe upon crocodilian remains from the Judith River (Belly River) formation of Alberta, Canada. Lambe says: "The material from Red Deer River includes a left mandibular ramus, the posterior part of a cranium, portions of the skull, teeth, and a number of vertebræ and scutes. Of these specimens the ramus of the lower jaw is selected as the type of the species; the other specimens, of which the back portion of the cranium may be regarded as the cotype, are associated with the type."

^a The geographical location of these specimens (Cat. Nos. 984 and 5898, American Museum of Natural History) is well shown on a small sketch map of the western half of Dawson County, Montana, published by B. Brown. Bull. Am. Mus. Nat. Hist., vol. 23, 1907, fig. 1.

^b Trans. Royal Soc. Canada, vol. 1, 1908, pp. 219-235, pls. 1-5.

The chief generic distinction was found in the contribution of the splenial to the symphysis which was equal to one-fifth of the latter's length.

Leidyosuchus canadensis Lambe is the type-species of the genus.

The characters displayed by the specimens considered in the preceding pages, combined with those shown by the Judith River species, show that the genus *Leidyosuchus* may now be characterized as follows: *Generic characters*.—Cranium short and of moderate breadth; palatal aspect of the premaxillæ slightly lengthened, with posterior borders convex and indented medially by the anterior processes of the maxillæ. Nasals not (?) reaching nares. Frontals contributing to boundary of supratemporal fossa. Premaxillary fissure and external nares both heart-shaped. Posterior nares wholly inclosed by pterygoids and placed about their middle. Mandibular symphysis short and contributed to by the splenial. Upper teeth more numerous than lower; first lower received into a pit and third and fourth into a notch in the cranium; third lower quite as large as fourth. Vertebra procoelian. A dorsal and ventral armour.

Discussion.—A study of the specimens considered in the preceding pages confirms the conclusions of Lambe, that *Leidyosuchus* represents a procoelian, brevirostrate form of *Eusuchia*.

A review of the characters of the skull shows that they combine those which have been attributed to the genus *Crocodylus* and the genus *Alligator*. The resemblances to the latter may be seen in the reception of the anterior teeth of the lower jaw in pits which do not perforate the dorsal surface of the premaxillæ; in the relative size and everted position of the orbits; and in apparently having the smaller lower teeth biting within the upper teeth. On the whole, however, the characters displayed by the known specimens of *Leidyosuchus* places that genus nearer to the crocodiles than otherwise.

Lambe has already called attention to the resemblance of the dentition to that of *Diplocynodon*, and the discovery and study of more complete material than that to which he had access show other resemblances. The more important likenesses are the participation of the frontal in the boundary of the supratemporal fossa; and the exclusion (?) of the nasals from the anterior narial opening.

The intermediate position of the posterior nares is one of the interesting features of this genus, and entirely in accord with its geological position. For instance, in the Triassic *Belodon* the posterior nares open in front of both palatines and pterygoids. In the Jurassic *Teleosaurus* the posterior nares are farther back and surrounded by the palatines. In the Cretaceous *Leidyosuchus* they lie still farther back, in the middle of the pterygoids. Finally, in the Tertiary forms the arrangement is approximately as found in living crocodiles.

In the matter of the splenial contributing to the symphysis, *Leidyosuchus* may be considered ancestral to such Wasatch forms as *Crocodylus polyodon* Cope and *C. subulatus* Cope. The relationship of these forms is still further indicated by their reference by Professor Cope to *Diplocynodus*^a (*Diplocynodon*) on account of the presence in the upper mandible of two adjacent enlarged teeth. Later^b, however, both species were provisionally assigned to the genus *Crocodylus* by the same authority.

In *Leidyosuchus* and the gigantic *Deinosuchus* recently described^c by Dr. W. J. Holland, we have in the Judith River beds the first authentic record of the appearance of procoelian crocodiles in the Cretaceous of the Rocky Mountain region.

EXPLANATION OF PLATES.

PLATE 23.

Skull of *Leidyosuchus sternbergii*. Cat. No. 6533, U.S.N.M. One-half natural size. Seen from above.

e. na., external nares; *ex. occ.*, exoccipital; *fr.*, frontal; *i. t. f.*, infratemporal fossa; *ju.*, jugal; *la.*, lachrymal; *mx.*, maxillary; *n.*, nasal; *o.*, orbit; *oc. c.*, occipital condyle; *pa.*, parietal; *p. f.*, postfrontal; *p. fr.*, prefrontal; *pmx.*, premaxillary; *pt.*, pterygoid; *q.*, quadrate; *q. ju.*, quadrato-jugal; *s. t. f.*, supratemporal-fossa; *sq.*, squamosal.

PLATE 24.

Skull of *Leidyosuchus sternbergii*. Cat. No. 6533, U.S.N.M. One-half natural size. Seen from below.

a. p. v., anterior palatine vacuity; *b. occ.*, basioccipital; *b. s.*, basisphenoid; *m. e. c.*, median eustachian canal; *mx.*, maxillary; *oc. c.*, occipital condyle; *p.*, palatine; *pmx.*, premaxillary; *p. na.*, posterior nares; *p. p. v.*, posterior palatine vacuity; *pt.*, pterygoid; *q.*, quadrate; *q. ju.*, quadrato-jugal; *t. p.*, transpalatine.

PLATE 25.

Skull and jaws of *Leidyosuchus sternbergii*. Cat. No. 6533, U.S.N.M. One-half natural size. Lateral view.

ang., angular; *d.*, dentary; *e. m. f.*, external mandibular foramen; *ju.*, jugal; *mx.*, maxillary; *pmx.*, premaxillary; *q.*, quadrate; *q. ju.*, quadrato-jugal; *s. ang.*, surangular; *sq.*, squamosal.

PLATE 26.

Skull of *Leidyosuchus sternbergii*. Cat. No. 6533, U.S.N.M. Natural size. Posterior view.

b. occ., basioccipital; *b. s.*, basisphenoid; *c. a.*, foramen for carotic artery; *ex. occ.*, exoccipital; *f. m.*, foramen magnum; *m. e. c.*, median eustachian canal; *oc. c.*, occipital condyle; *pt.*, pterygoid; *q.*, quadrate; *vii, x, xii*, foramina for cranial nerves.

^a Sixth Ann. Rept. U. S. Geol. Surv. Terr. for 1872, 1873, pp. 613-614.

^b Rept. U. S. Geol. Surv. Terr., vol. 3, 1884, p. 154, pl. 31, figs. 18-23.

^c Annals of the Carnegie Museum, vol. 6, 1909, pp. 281-294.

PLATE 27.

Lower jaw of *Leidyosuchus sternbergii*. Cat. No. 6533, U.S.N.M. One-half natural size. Superior view.

ang., angular; *art.*, articular; *d.*, dentary; *f.*, postsymphysial foramen; *i. m. f.*, internal mandibular foramen; *s.*, splenial; *s. ang.*, surangular.

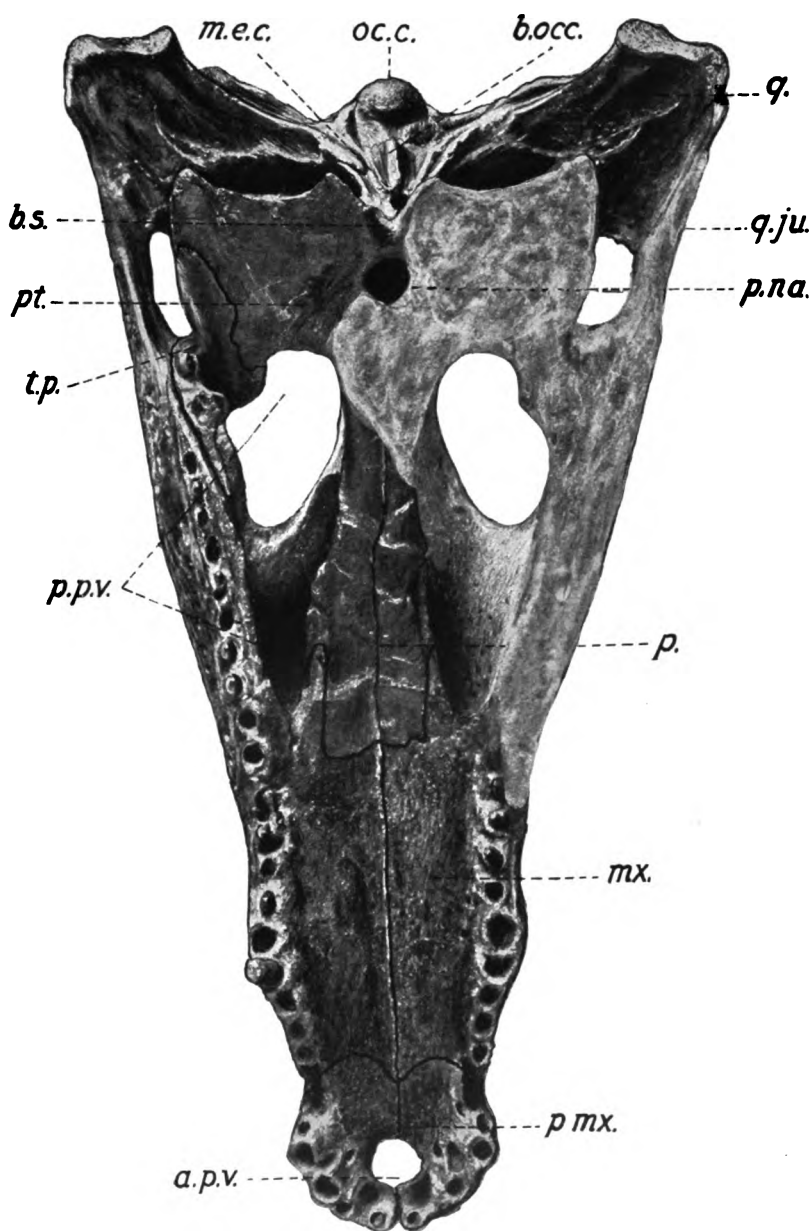
PLATE 28.

Skull of *Leidyosuchus sternbergii*. Cat. No. 5898, Amer. Mus. of Nat. History. One-half natural size. Seen from above.

PLATE 29.

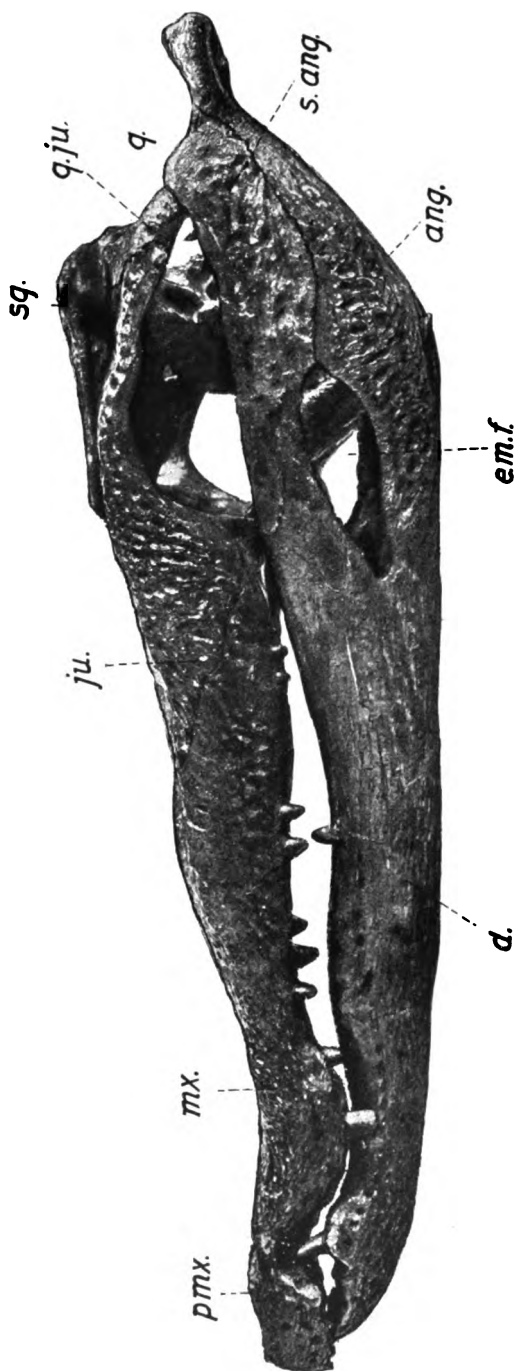
Skull of *Leidyosuchus sternbergii*. Cat. No. 5898, Amer. Mus. of Nat. History. One-half natural size. Seen from below.

a. p. v., anterior palatine vacuity; *mx.*, maxillary; *q.*, quadrate; *p.*, palatine; *pmx.*, premaxillary; *p. n.*, posterior nares; *pt.*, pterygoid.



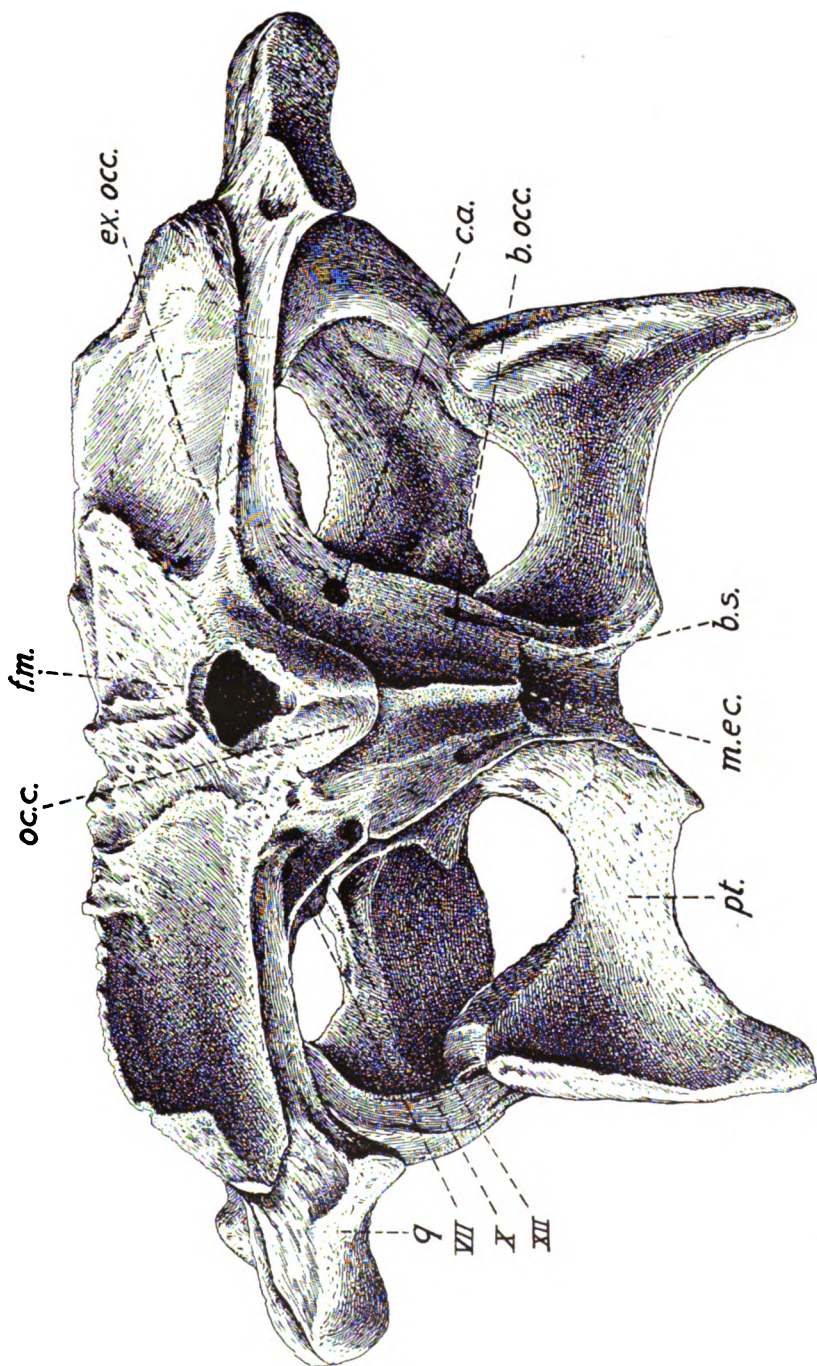
SKULL OF LEIDYOSUCHUS STERNBERGII.

FOR EXPLANATION OF PLATE SEE PAGE 501.



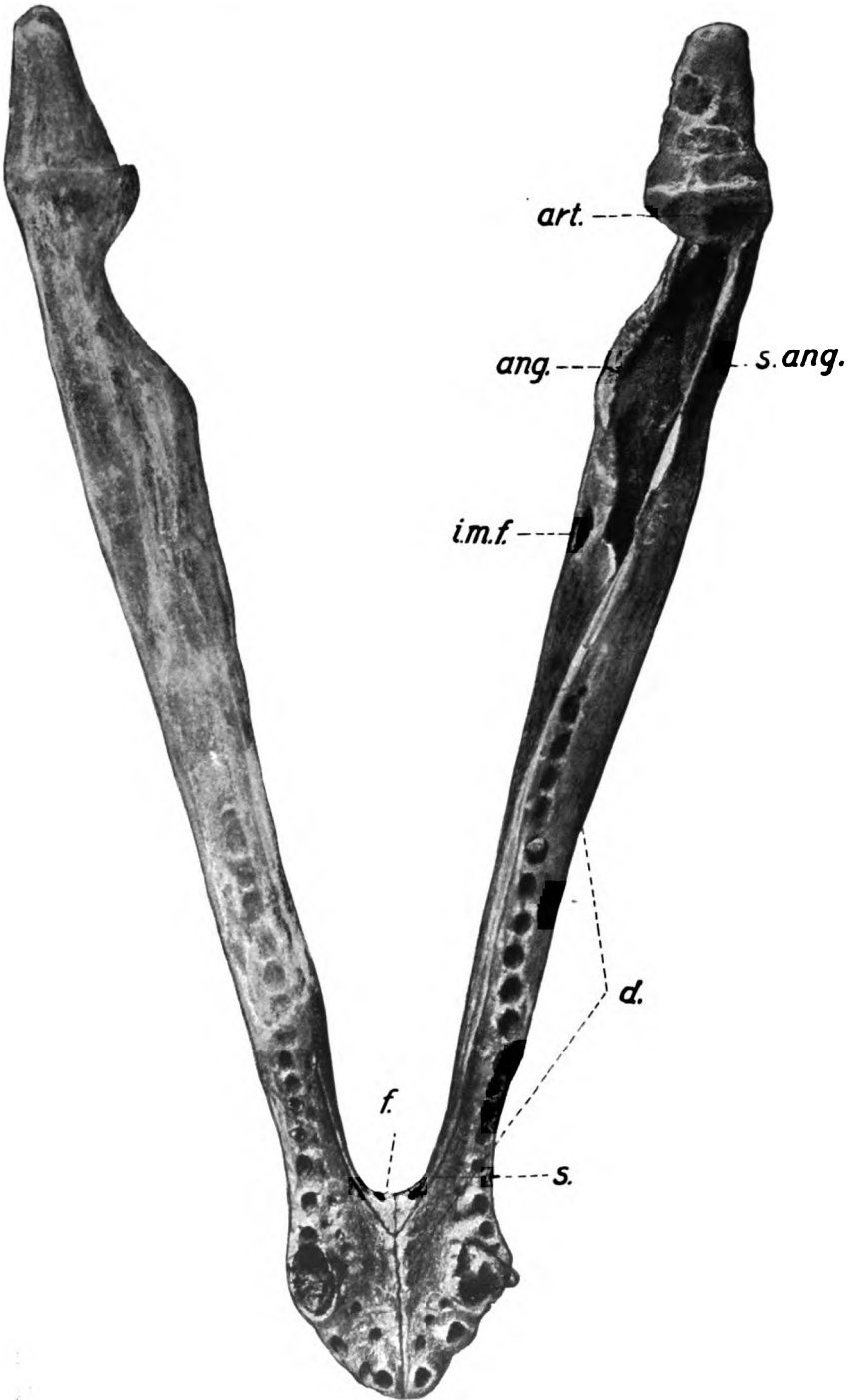
SKULL AND JAWS OF *LEIDYOSUCHUS STERNBERGII*.

FOR EXPLANATION OF PLATE SEE PAGE 501.



SKULL OF LEIDYOSUCHUS STERNBERGII.

FOR EXPLANATION OF PLATE SEE PAGE 501.



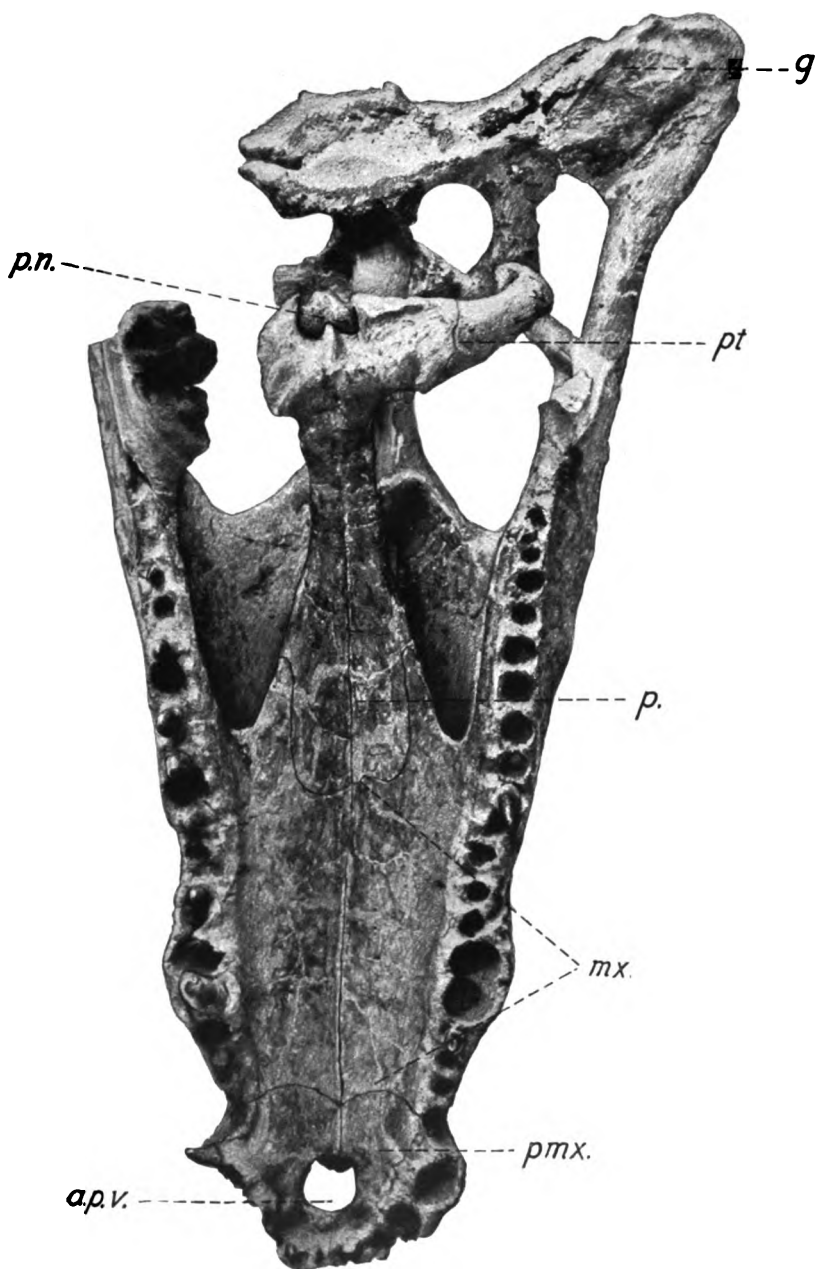
LOWER JAW OF LEIDYOSUCHUS STERNBERGII.

FOR EXPLANATION OF PLATE SEE PAGE 502.



SKULL OF LEIDYOSUCHUS STERNBERGII.

FOR EXPLANATION OF PLATE SEE PAGE 502.



SKULL OF LEIDYOSUCHUS STERNBERGII.

FOR EXPLANATION OF PLATE SEE PAGE 502.

REPORT ON THE FISHES COLLECTED BY MR. OWEN
BRYANT ON A TRIP TO LABRADOR IN THE SUMMER OF
1908.

By WILLIAM CONVERSE KENDALL,
Assistant, U. S. Bureau of Fisheries, Washington.

During the summer of 1908 Mr. Owen Bryant made very extensive collections of marine animals along the coasts of Labrador and Newfoundland. Most of the specimens brought back were of invertebrate types, but included among them were a few fishes. These were turned over to Mr. Austin H. Clark for study and report; he was unable, however, in connection with his other work, to devote the necessary time to them, and he therefore requested me to examine them and to draw up an annotated list of the species represented.

The collection consists of only fourteen species, of which seven are young and larval forms taken in a tow net and dredge. Satisfactory identification of some of these young individuals is difficult, but, although the identifications of these are not absolutely positive, it is hoped that they are correct.

Of the fourteen species taken on the trip twelve are from Labrador, one from Newfoundland, and one from St. Pierre. Two of the species collected have not previously been definitely recorded from Labrador, which shows the desirability of collections, however small, from that region.

1. (?) *SALVELINUS STAGNALIS* (Fabricius).

Through the kindness of Mr. J. T. Nichols the writer was privileged to examine six "sea trout" sent to him by Mr. Bryant. The fish had been split and salted, but were otherwise in fairly good condition and showed the colors very well. Regarding these fish Mr. Bryant wrote in a letter dated December 26, 1908:

Trout caught at Komaktorvik Bay, Labrador, in salt water, September, 1908, called "sea trout." There were just a few in places; you could almost walk across the rivers on them without wetting your feet, or, to be more exact, they were only about one or two feet apart all over the shoal places. Ford used to take a net and get enough out of a river to last him through the winter for dog food.

These specimens made it very evident that there exists, in Labrador at least, a "sea trout" very different from the sea-run form of the brook trout (*Salvelinus fontinalis*).

While they differ in some minor details, they are specifically identical with specimens in the U. S. National Museum from Greenland, and also with specimens collected by Mr. L. M. Turner in the Ungava Bay region.

Storer's brief description of *Salmo immaculatus* is explicit enough to indicate that it is this same species and not the sea-run brook trout (*S. fontinalis*). For the purpose of comparison the Boston Society of Natural History very kindly loaned the writer specimens of Salmonidæ collected in Greenland by the Williams College Expedition in 1860, and in Labrador by Prof. A. S. Packard in 1864. Unfortunately, the type of *Salmo immaculatus* could not be found; but the specimens received supported the identification. Regarding some of them Packard wrote:^a

Salmo immaculatus H. R. Storer. Three specimens from near Hopedale were collected July 29th. These specimens are unquestionably referable to the *S. immaculatus* of Storer and are distinct from the *S. trutta* of Europe, with which species Perley and others have confounded them. They differ from *S. trutta* by having larger scales and being without spots, as their name indicates (Putnam).

Putnam was undoubtedly familiar with the type of *S. immaculatus*.

In the Packard collection were also two specimens concerning which he wrote:^a

Salmo sp.? Two specimens from the Island of Ponds, near Domino Harbor, collected in July. This species, which, from its rather imperfect condition, I have not been able to recognize, appears to be closely allied to the *S. trutta* of Europe, being spotted as in that species, but of somewhat different shape, especially about the head. There are also specimens from Greenland belonging to this species in the collection of this society, collected by the Williams College Expedition to Greenland and Labrador in 1860.

These specimens were undoubtedly correctly identified with the Greenland specimens with which the present writer compared them, but Putnam was mistaken regarding the spots. *Salmo trutta* has dark spots, and the spots of this form are light, pink or red. However, no spots are visible at this time on the specimens under discussion. It is not stated whether these specimens were taken in the sea, brackish or fresh water, but one of them to a greater extent than the other resembles a trout of the *S. alpinus* group from fresh water. There are certain differences in measurements between these and the Greenland specimens mentioned, but apparently they can mostly be accounted for by the differences in the sizes of the individuals.

In the description of *Salmo immaculatus* Storer gave the diagnostic points of difference between that species and *S. fontinalis*, and, although they have been ignored, there are good and strong specific differences. These are: "Preopercle larger than in *S. fontinalis*," "scales larger than those of *S. fontinalis*," "caudal deeply forked."

^a The Labrador Coast, p. 400.

Suckley^a severely criticised Storer for describing what he (Suckley) was strongly inclined to consider a young fish:

The naming of Salmonidæ, and the description of new species, based upon the characters of young, partially developed fish, can not be too strongly reprobated. There is already too much confusion in the synonymy of the various kinds; and if the practice of describing and naming new species from the characters of unidentified, immature individuals is not stopped the study of the relations of the species will become so complicated that useful classification will be next to impossible and the principal object and usefulness of scientific arrangement, such as simplifies the study of natural history in other branches, will be greatly impaired.

The length of Storer's single specimen was 13½ inches. It was taken at Red Bay, Labrador.

Yet Suckley^b himself described *Salmo hudsonicus* from a specimen 16½ inches long, from Hudson Bay, the diagnostic differences from *S. fontinalis* being "a smaller head, larger spots, and larger, more adherent scales." This, too, has been consigned by later ichthyologists to the synonymy of *S. fontinalis*.

There were six specimens sent by Mr. Bryant ranging in total length from 15½ to 20 inches, which, aside from the different coloration, differ from *S. fontinalis* in a number of characters, particularly the deeply forked tail of the fish of these sizes, the somewhat larger scales (about 200 in lengthwise series), and the more advanced position of the eye, the distance from the eye to the edge of the gill cover being comparatively considerably greater. The vertebræ are 65 in number.

The color of the different individuals varied somewhat, but all were essentially alike. A fish 15½ inches long showed the following coloration: Back steel gray with metallic reflections; head similar on top, silvery on side; lower jaw and branchiostegals white; sides silvery; belly white; numerous small pink spots on back and sides above the lateral line, each occupying from four to six scales; on the silvery portion of the side and below lateral line, and posteriorly a little above lateral line, large pink spots, half diameter of eye; dorsal adipose and caudal plain steel gray; pectoral, ventral, and anal white; pectoral dusky and yellowish behind, ventral pinkish; no spots on head or caudal.

The gills had been removed from these fish, but the number in the same species above mentioned from Labrador and Greenland ranged in number from 22 to 26, that is: 8+14 to 10+16. The specimen having 8+14, however, had 9+15 or 24 on the right side, and the specimen having 10+16 or 26 on the right side had 9+15 or 25 on the left side. The specimen from Hopedale identified by Putnam as *Salmo immaculatus* had 10+15 or 25 on each side.

^a Suckley, On the North American Species of Salmon and Trout, Report U. S. Fish Comm. for 1872 and 1873 (1874), p. 113.

^b Suckley, Notices of Certain New Species of North American Salmonidæ. "N. Y., June, 1861," and Report U. S. Fish Comm. for 1872 and 1873 (1874), p. 119.

Salvelinus fontinalis from the same region had 18 as the maximum number of gill-rakers, usually 7 + 11.

The accompanying Plate (30) was reproduced from a photograph taken by Mr. Thomas E. B. Pope, of the Bureau of Fisheries, from one of the Bryant specimens, 15½ inches long, above described.

It would not be surprising to find that the range of this form extended farther westward along the Quebec shores and southward along the Newfoundland coast. If such be the case it would account for the decidedly antagonistic views regarding the identity of the "sea trout" of Canada, which have for so many years been a matter of serious discussion in sportsmen's journals and elsewhere, both by anglers and by ichthyologists. Many, especially anglers, maintain that the Canadian "sea trout" is a distinct species. Others claim that it is but a "sea-run" form of the common brook trout (*Salvelinus fontinalis*). The discussion has appeared at irregular periods in *Forest and Stream*, but never has been definitely settled. However, about 1905 the arguments were brought to a close apparently in favor of the brook-trout advocates. During the later discussions the fact that it had been pointed out that there were at least two species of "sea trout" was lost sight of. In *Forest and Stream* ^a an article by Tarleton H. Bean on Salmon and Trout in North America, specifies the "sea trout" as *Salvelinus stagnalis*, and under the heading "Brook Trout" states that it "has a reputation for sea going." Again in the next volume ^b "T. H. B." [Tarleton H. Bean] writes:

It is well known that the American brook trout (*Salvelinus fontinalis*) leaves certain fresh-water streams for a portion of the year and goes to sea. This is true in regions where it is not cut off from access to the ocean by intervening areas of lowland traversed by streams of high temperature. The sea-going habit is more pronounced as we approach the northern limit of trout distribution. We think there is still some doubt as to the proper application of the name "sea trout" in Canada. The *fontinalis* certainly may be included under this title, but we believe that another and larger species, which is better entitled to the name "sea trout," occurs in Canadian waters. We refer to the great sea trout of Labrador, *Salvelinus stagnalis*. This splendid fish grows very large, much larger than *fontinalis*, attaining the proportions and shape of the Atlantic salmon. It is well known to anglers and fishermen, and the fishing for it is prosecuted extensively in the sea. This species, according to Mr. L. M. Turner, spawns only in large streams and does not penetrate far inland.

On the Pacific slope the Dolly Varden becomes a sea trout, especially in Alaska, where it is known commercially under the name of salmon trout. This handsome species is found in the bays during a large portion of the year. Some individuals exceed two feet in length. When taken from the salt water they are brilliant silvery, with scarcely a trace of red spots, but exposure to the sun or immersion in fresh water will soon cause the spots to appear.

We have thus far spoken only of trout belonging to the genus *Salvelinus*, and we have made no mention of some species which occur only in the high northern regions

^a Vol. 32, April 4, 1889, Supplement, pp. 219-222.

^b Vol. 33, November 7, 1889, p. 312.

of our country. It may not be amiss to remark, in addition, that several species of *Salmo*, or large river trout, also have the sea-going habit well developed. These include the brown trout, the rainbow, steelhead, and redthroat.

Subsequent disputants, however, ignored or were ignorant of this plausible suggestion and continued to enunciate their views and denounce their opponents in the arguments. But that two different fish were under discussion can not be doubted.

To the present writer it seems doubtful whether the name *Salvelinus stagnalis* can properly be given to this species. It is a name bestowed by Fabricius^a upon a small trout which inhabited the remoter mountain waters of Greenland from which, it was said, it never descended to the sea ("*Habitat in aquis montanis remotioribus, inde numquam descendens.*").

If other small salmonids of the fresh waters of Greenland can be regarded as distinct species or subspecies (*S. arcturus* and *S. naresi*) there is nothing to indicate that *S. stagnalis* is not one of these.

Our fish is undoubtedly the same form that was described by Fabricius^b under the name of *Salmo carpio*, by mistake.

Dressel,^c regarding a fish which he identified as *Salvelinus stagnalis*, says:

Although it is doubtful whether the species is the *Salmo stagnalis* of Fabricius, yet it agrees partly with the description and very closely with Doctor Richardson's description of *Salmo alipes*, which is probably identical with *S. stagnalis*. It differs from *S. carpio* Fabricius in being more elongate and in the absence of the black quadrate spots mentioned in his description.

The "more elongate form" counts for nothing, since individuals vary in this respect, and Dressel attaches too much importance to the absence of "black quadrate spots" mentioned by Fabricius. Regarding this character, Fabricius says: "Scales with dusky margins, and causing as it were quadrate spots, which, however, are not easily perceived." (*Color dorsi obscure cærulescit, tinctura subviridi, squamarum marginibus tamen nigrantibus, et quasi maculas quadratas causantibus, quæ tamen non facile observantur.*)

It is very likely a sea-run form of the fish that Fabricius designated as *Salmo alpinus*, which may be identical with one or more of Richardson's species, perhaps *Salmo alipes*, as suggested by Dressel and others.

Storer's name *Salmo immaculatus* is preoccupied and could not be used for it if it should, by chance, prove to be without a name. But this contingency is doubtful.

^a *Fauna grælandicus*, 1780, p. 175.

^b *Idem*, p. 170.

^c Notes on some Greenland Fishes, Proc. U. S. Nat. Mus., vol. 7, 1884, p. 255.

2. *MALLOTUS VILLOSUS* (O. F. Müller).

CAPELIN.

Two males, 6½ and 7½ inches long from Greely Harbor, August 8.

One larva or fry 13 mm. in length was taken in Greely Harbor and Egg Harbor towings, August 8 to 10.

3. *GASTEROSTEUS CUVIERI* Girard.

STICKLEBACK.

Eight young individuals 12 to 18 mm. in total length from Indian Harbor, August 12. Absolutely no lateral dermal plates visible under hand lens excepting in the largest three individuals which show traces of from three to five on each side. No information is given regarding whether these fish were taken in fresh, brackish, or salt water. The feeble armature suggests that the habitat was fresh water.

4. *ICELUS BICORNIS* (Reinhardt).

One specimen 29 mm. long from Komaktorvic Bay, north of Nakvak, in 5 fathoms, rocky bottom, August 28.

This specimen seems to have a simple upper preopercular spine.

Two specimens from 17 to 19 mm. in length respectively; the definite locality not given; upper preopercular spine simple. The non-bifurcate upper preopercular spine may be due to the youthfulness of the individuals.

5. *MYOXOCEPHALUS SCORPIOIDES* (Fabricius).

ARCTIC SCULPIN.

Six specimens of young 21 to 24 mm. long from Fog Island, Seldom-come-by Bay, Newfoundland, July 28. These specimens, like all very young of the genus, have four preopercular spines instead of three as in the adults; conspicuous nasal, supra-orbital and occipital spines, the latter in pairs or deeply bifid on each side in all but one individual in which it is simple. The dorsal formula is uniformly IX or X, 17, and the anal 14.

The ground color is pale, the head dotted with brown on sides and black dots on top. Large stellate brown pigment dots along back to posterior end of dorsal fin; few on body in front of pectoral; from backward about one-third of length of soft dorsal these dots extend downward and backward to a point about one-third of the length of anal from its anterior end, thence posteriorly the body is thus pigmented to a line from the posterior end of the second dorsal and the end of the anal.

The caudal peduncle and all the fins are pale; peritoneum showing dark brown or black, through the abdominal wall at line of junction of abdomen and body.

6. *MYOXOCEPHALUS GRÆNLANDICUS* (Cuvier and Valenciennes).

GREENLAND SCULPIN.

One specimen $9\frac{1}{2}$ inches long from 10 miles north of Nain, Labrador; August 20. The supraorbital and occipital spines have a short cirrus on the apex of each.

7. *GYMNOCANTHUS TRICUSPIS* (Reinhardt).

One specimen $7\frac{1}{4}$ inches long from 10 miles northeast of Nain, August 20.

8. *CYCLOPTERUS LUMPUS* Linnaeus.

LUMPFISH.

One specimen, young, 14 mm. long from St. Pierre, October 1; 5 fathoms; rocks and gravel.

9. *LIPARIS TRUNCATUS* Reinhardt.

Three specimens 40, 43, and 70 mm. long, respectively, from Komactorvic Bay, north of Nakvak, Labrador, in 5 fathoms; rocky bottom; August 28.

10. *LYCODES VAHLII* Reinhardt.

One specimen presumably of the young of this species was taken "Half-way from Cape Mugford to Hebron in 60 fathoms; mud and sand bottom, August 23." Total length, 79 mm.; head in that length, 4.64; depth, 8.77; pectoral, 8.77; eye, 4.25 in head; snout, 3.40; no scale evident.

11. *LYCODES RETICULATUS* Reinhardt.

One young specimen which seems to be of this species was taken from off Cape Harrison in 70 fathoms; "no bottom brought up;" August 13. Total length 65 mm.; head in that length 4.33; depth, 7.22; pectoral, 9.5; eye, 4.5 in head; snout, 4.5.

The coloration of this and the preceding specimen is very much the same, as appears to be the case with the young of most of the *Lycodes*, which makes them difficult of identification.

This specimen seems to be identical with the form called *Lycodes perspicillum* by Krøyer.

The writer has followed Smitt in Scandinavian fishes in considering it the young of *L. reticulatus*.

12. *BOREOGADUS SAIDA* (Lepechin).

One specimen doubtfully the young of this species, 18 mm. long, from 30 miles southeast of Nain, August 15.

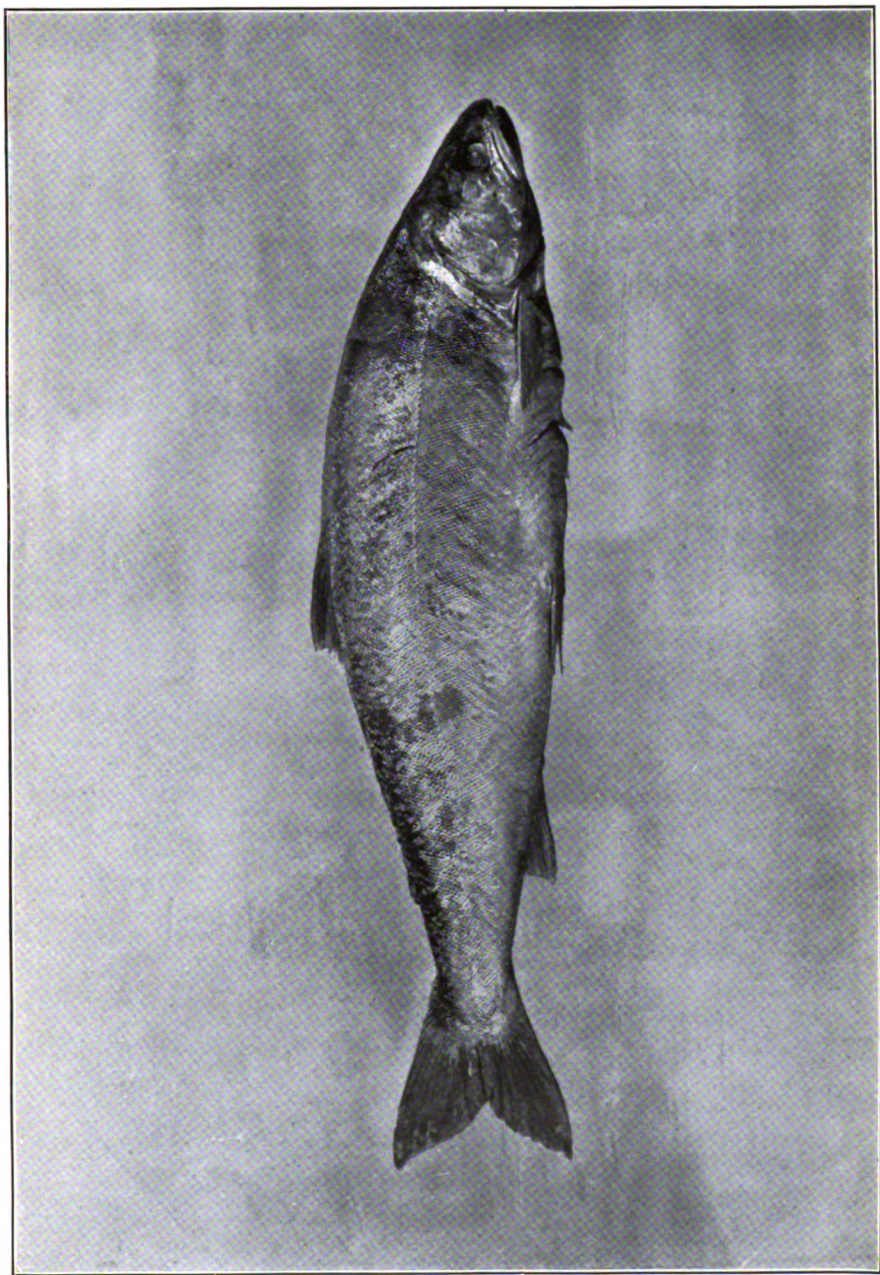
13. *GADUS OGAC* Richardson.

One specimen about 11 $\frac{3}{4}$ inches long from 10 miles northeast of Nain, August 20.

Head, 3.45; depth, 4.1; snout, 2.72; maxillary plus premaxillary, 2.11; interorbital much wider than eye; barbel nearly equals eye; pectoral, 2.1; D. i13-14-i15; A. i16-ii16. An oblique white spot near posterior base of first dorsal; peritoneum brownish-black.

14. *HIPPOGLOSSUS HIPPOGLOSSUS* Linnaeus.*HALIBUT.*

A larval flatfish only a few millimeters long (5 or 6) from north of Hebron, September 1, seemed to be a halibut from the vertebral count, although this was uncertain; it was a large-mouthed form and could possibly have been some other species. The specimen was unfortunately lost before being definitely determined.



SALVELINUS STAGNALIS.

FOR EXPLANATION OF PLATE SEE PAGE 506.

A REVIEW OF THE VENOMOUS TOADFISHES.

By BARTON A. BEAN and ALFRED C. WEED,
Of the Division of Fishes, U. S. National Museum.

The venomous toadfishes, genera *Thalassophryne* and *Thalassothia*, are distinguished not alone from other members of the family *Batrachoididae* but from all other fishes, so far as known, by the possession of spines which are perforated for the passage of a venom canal similar to that in the fang of a serpent. (See figs. 1-2.) It is probable that nearly all members of the family have the poison glands more or less well developed, but, so far as is known, in only the two genera mentioned are the spines perforated. Some other species have the spines more or less grooved. (See fig. 3.) The presence of poison glands and of specialized organs for introducing the secretion of these glands into the bodies of other animals is not at all

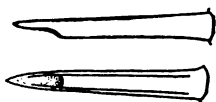


FIG. 1.—DORSAL SPINE OF
THALASSOPHRYNE DOWL.

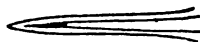


FIG. 2.—OPERCULAR SPINE OF
THALASSOPHRYNE DOWL.



FIG. 3.—OPERCULAR SPINE
OF PORICHTHYS GREENIEI.

uncommon in fishes and is not confined to any one group or family; also it is not necessarily a characteristic of all members of any group where it may be found.

The presence of venomous organs among fishes has been denied more or less strongly at times, but is now well proven in many cases and will doubtless be shown in many others as a result of careful study with proper apparatus and manipulation. It has been long known that the wounds caused by the spines of certain fishes produced symptoms far more serious than could be accounted for by the mere mechanical laceration produced by the spines. In some of these cases later research has shown the presence of poison glands on or near the spines, while in the sting rays (*Dasyatis*) and other fishes no such structures have yet been found.

The first record of the specialized venom apparatus of *Thalassophryne* was made in 1864 when Dr. Albert Günther described and figured it.^a His description has been copied many times by various authors. The best abstract of it is probably that given by Dr. Theodore N. Gill^b in his paper on Life Histories of Toadfishes, etc.

To this account we may add that in the specimen of *Thalassophryne reticulata* which we very carefully examined, and in which the skin over the point of the opercular spine had not been ruptured, the poison sac lay along the whole outer surface of the spine and not merely at its base. The sac is so placed that any pressure tending to cause the spine to pierce the skin would produce a corresponding pressure on the contents of the sac and cause the poison to flow into the wound with considerable force. In one specimen the pressure that exposed the point of the spine in a fish that had been in alcohol nearly thirty years caused the contents of the sac to be ejected to a distance of 2 or 3 feet. An unsuccessful attempt was made to test the poisonous properties of the contents of the sac. The failure may have been due to a reduction of the poisonous qualities by preservation or to failure to inject the hardened secretion into the wound. In 1865 a letter from Captain Dow to Doctor Günther was read before the Zoological Society of London,^c in which he described the poison as producing fever similar to the effects of the sting of a scorpion. He adds that serious effects from the poison are very rarely known.

For the purpose of this review we have brought together twenty-one specimens representing five species, including specimens which are evidently Steindachner's cotypes of *Thalassophryne punctata* and *T. nattereri*. We can find no characters which will enable us to separate *Thalassophryne maculosa* Günther from *T. nattereri* Steindachner, so have adopted the older name. This makes *Thalassophryne maculosa* a rather variable species, but the specimens at hand intergrade so closely that we can not separate it at any point. It is possible, although not very probable, that the examination of a large number of specimens would still further reduce the number of species credited to the east coast of South America. We describe one new species, based on the possession of broad incisor teeth and very large eyes. The teeth are very different from those of any other species of *Thalassophryne* known to us, but resembling most closely those of *Thalassophryne reticulata* and being a great development of the tendency shown in the teeth of this species.

^a Proc. Zool. Soc. London, 1864, p. 157, figs. 1 and 2.

^b Life Histories of Toadfishes (Batrachoidids), compared with those of Weevers (Trachinids), and Stargazers (Uranoscopids). Theodore Gill, Smithsonian Miscellaneous Collections (Quarterly Issue), vol. 48, pt. 4, pp. 388-427. *Thalassophryne* is mentioned and figured on pages 402 and 403.

^c Proc. Zool. Soc. London, 1865, p. 677.

The similarity in appearance between *Thalassophryne* and *Porichthys* is shown by the fact that one of the three specimens on which *Thalassophryne dowi* was founded proves to be *Porichthys greeniei*.

In our descriptions of species of *Thalassophryne* we have omitted the fish described by De Vis as *Thalassophryne cæca*,^a as it is clear from the evidence at hand that this is not a *Thalassophryne*, and it is not certain that it is closely related to that genus. De Vis does not state whether the dorsal spines are hollow or not, and it is not certain from his description that there is an opercular spine developed as a poison organ. He says "gill covers with five spines." If this means that there are five opercular spines, the fish is very different from *Thalassophryne* and closely related to *Opsanus*, if, indeed, it does not belong to this genus. If, on the other hand, the statement quoted means that the author was misled by appearances and considered the branchiostegal rays as spines, the species is probably a *Porichthys*. The mere fact of the presence of two dorsal spines does not prove the relationship of the fish to *Thalassophryne*. The eye in many species of toadfishes is so small and the iris is colored so much like the rest of the fish that it might easily appear as "an oval spot of lighter colored skin" in a mounted specimen.

In *Thalassophryne* the first ventral ray is simple and articulated, with the spines closely appressed to it at its base, while the second ray is divided to its base.

It is quite remarkable that although many poisonous fishes have the spines grooved, only a single small group, confined, so far as known, to Tropical and South Temperate America, should have developed the apparatus more fully by roofing over the groove and rendering more certain the entrance of the poison into the wound.

We are indebted to the following museums for the loan of material: Stanford University, Museum of Comparative Zoology, Cornell University, and Indiana University.

KEY TO THE GENERA OF VENOMOUS TOADFISHES.

- a¹. Opercular spines hollow for the passage of a venom canal; gill membrane narrow; teeth blunt conic or incisor, not canine.
 b¹. Dorsal spines two, hollow..... *Thalassophryne*.
 b². Dorsal spines four, the first two hollow..... *Thalassothia*.

Genus THALASSOPHRYNE Günther.

Thalassophryne GÜNTHER, Cat. Fish Brit. Mus., vol. 3, p. 175 (1861); Proc. Zool. Soc. London, 1864, p. 150; Trans. Zool. Soc. London, vol. 6, 1865, pp. 436-439, pl. 68.

Thalassophryne MEEK and HALL, Proc. Acad. Nat. Sci. Phila., 1885, pp. 52-62.

Thalassophryne JORDAN and EVERMANN, Bull. 47, U. S. Nat. Mus., vol. 3, p. 2323 (Nov. 26, 1898).

^a Proc. Linn. Soc. New South Wales, vol. 9, 1884, p. 546.

Dæctor JORDAN and EVERMANN, Bull. 47, U. S. Nat. Mus., vol. 3, p. 2325 (Nov. 26, 1898).

Thalassophryne OGILBY, Ann. Queensland Mus., no. 9, pt. 2, 1908, pp. 46 and 55.

Dæctor OGILBY, Ann. Queensland Mus., no. 9, pt. 2, 1908, pp. 46 and 54.

Dorsal spines two, perforated for the passage of a venom canal as in *Thalassothia*.

Operculum developed as a slender spine, hollow like the dorsal spines.

Teeth blunt conic; present on mandible, maxillary, vomer, and palatines.

Gill membrane narrower than in *Porichthys*, reaching about to the end of the opercular spine.

This genus differs from *Thalassothia* in the number of dorsal spines; in the first rays of the anal not being separated from the rest of the fin, and probably in the somewhat slenderer body.

Thalassophryne differs from *Porichthys* in the dentition, in the character of the spines, and in the width of the gill membrane.

The teeth of *Thalassophryne* resemble those of young specimens of *Opsanus tau* very closely and are very different from those of *Porichthys*.

KEY TO THE SPECIES OF THALASSOPHRYNE.

a¹. Eye small, 8 to 12 in head, teeth conic, more or less flattened at tip.

b¹. Dorsal and anal fully joined to caudal.

c¹. Dorsal and anal long, about 30 rays in each.....*dowi*.

c². Dorsal and anal shorter, about 20 rays in each.....*amazonica*.

b². Dorsal and anal not united to caudal, the fin membrane behind last rays reaching to base of outer caudal rays.

d¹. Teeth conic, only slightly flattened at tip.

e¹. Color dark brown with numerous spots of black the size of the eye and smaller. Teeth in a narrow patch across head of vomer.....*punctata*.

e². Color brown, more or less marbled with darker but without conspicuous spots of black. Teeth in a single row across head of vomer.....*maculosa*.

d². Teeth broad, almost incisor, oval in front view with a long cutting edge; color dark grayish with a reticulation of grayish white lines.....*reticulata*.

a². Eye large, 5 to 6 in head, teeth broad incisors, cutting edge nearly straight.*megalops*.

THALASSOPHRYNE DOWI Jordan and Gilbert.

Thalassophryne dowi JORDAN and GILBERT, Proc. U. S. Nat. Mus., vol. 10, 1887, p. 388.

Dæctor^a *dowi* JORDAN and EVERMANN, Bull. 47, U. S. Nat. Mus., pt. 3, p. 2325, Nov. 26, 1898.

Thalassophryne dowi GILBERT and STARKS, Mem. California Acad. Nat. Sci., vol. 4, 1904, p. 187.

^a We can find no characters except the slightly longer dorsal and anal fins, the somewhat more elongate body, and other differences in proportions which separate this species from the rest of the genus *Thalassophryne*. These characters taken alone are not worthy of generic or subgeneric rank. The main character on which the genus *Dæctor* was founded was the joining of the dorsal and anal fins to the caudal. This, taken in connection with the greater length of the dorsal and anal and the more elongate form would probably constitute a valid genus. However, *Thalassophryne*

Head $3\frac{1}{2}$. Depth $5\frac{1}{4}$. D. II-31. A. 30. P. 17. V. I, 2. C. 14.

Body comparatively elongate, compressed behind. Head low and rather narrow, its length $1\frac{1}{2}$ times its width.

Eyes very small, about $1\frac{1}{4}$ in snout and $2\frac{3}{4}$ in interorbital space, 11 in head. Interorbital width $4\frac{1}{2}$ in head. Opercular spine $3\frac{1}{2}$ to 4 in head. Mouth oblique, the lower jaw much projecting. Maxillary $2\frac{3}{4}$ in head, reaching behind eye. Mandible $1\frac{1}{2}$ in head. Teeth moderate, largest on palatines, present on premaxillaries, mandible, vomer, and palatines. Teeth in a very narrow cardiform band, scarcely more than one row, on mandible and premaxillary; sometimes plainly two rows on mandible. A single row across the head of the vomer and on the palatines. The teeth are all conic, slightly flattened at tip. In large specimens the two enlarged teeth on the head of the vomer are very much worn off and blunted by use. The teeth are somewhat longer than in others of the genus but do not form enlarged canines as in *Porichthys*. Pectoral fins obliquely rounded, $1\frac{1}{2}$ in head, reaching to about fifth anal ray. Caudal rounded. Last rays of dorsal and anal fully joined to caudal as in *Thalassophryne amazonica*.

Color in alcohol, dark gray, darkest at base of the dorsal fins, black on the spinous dorsal. Other specimens are reddish brown becoming black on the spinous dorsal and below the base of the soft dorsal. This ground color in either case is extensively broken up by fine marblings and mottlings of white or pale gray and disappears entirely above the middle of the side in the brown specimens. In the gray specimens the body color is carried farther down on the side and ends much less abruptly than in those with the brown color. The top of the dorsal, the end of the caudal and a short band on the ends of the last anal rays is black. Below or in front of this is a band of white in the brown specimens or of pale gray in the gray ones. This covers all but the extreme base of the dorsal rays and about half the length of the upper caudal rays. On the lower caudal rays and the anal the white or light gray is continuous with the color of the body. Just below the base of the dorsal the color is interrupted by the white lateral line.

We have examined and measured nine specimens of this species ranging from about 4.5 cm. to 15.6 cm. in total length. The list is as follows:

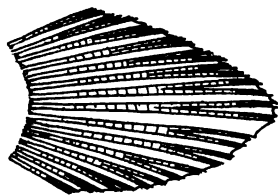


FIG. 4.—PECTORAL FIN OF PORICHTHYS GREENEI.

reticulata has only four or five fewer rays in dorsal and anal; *Thalassophryne amazonica* has a short dorsal and anal which are fully joined to the caudal, and a rather elongate form, and the teeth are the same in several other species of *Thalassophryne*, as in *T. dowi*. These considerations so reduce the value of the characters assigned to the genus *Dæctor* that we can not even accord it subgeneric rank.

No. 1555, Indiana University, Punta Arenas. Dredged. Coll. Dr. Wesley Newcomb. (Old number 923.) About 4.5 cm. long. This is one of the cotypes of *Thalassophryne dowi*.^a

No. 410, Leland Stanford Jr. University, Panama. Coll. *Albatross*. Two specimens, 6.5 cm. long and 14.1 cm. long.

No. 39085, U. S. Nat. Mus., Punta Arenas, Costa Rica. Coll. Dr. Wesley Newcomb. One specimen, 9.7 cm. long. Type of *Thalassophryne dowi*.

No. 41232, U. S. Nat. Mus., station 2800, str. *Albatross*, 8° 51' N., 79° 31' 30" W., March 30, 1888; 7 fathoms; bottom green mud. Bay of Panama. Two specimens, 10.6 cm. and 12.5 cm. long.

No. 41430, U. S. Nat. Mus., station 2800, str. *Albatross*. One specimen, 13.1 cm. long.

No. 6875, Leland Stanford Jr. University Museum, Panama. Coll. C. H. Gilbert. One specimen, 15.6 cm. long. This specimen was figured by D. S. Jordan in the plate which we copy from Proc. Cal. Acad. Sci. 1896, ser. 2, vol. 6, p. 231, pl. 38.

No. 2100, Cornell University Museum, Panama. Coll. Dr. Wesley Newcomb. One specimen, 11.3 cm. long.

^a The first recorded specimen of *Thalassophryne dowi* was collected by Dr. C. H. Gilbert through the agency of Captain Dow and was given the manuscript name *dowi* in his honor. This specimen was destroyed in the Indiana University fire. Later Dr. B. G. Wilder sent Dr. D. S. Jordan three specimens, probably collected by Captain Dow for Doctor Newcomb. These specimens were:

No. 1555, Cornell University Museum, from Panama. From Dr. Wesley Newcomb. Dredged. One specimen.

No. 1556, Cornell University Museum, Punta Arenas, Costa Rica. Dredged. Two specimens.

One specimen numbered 1556 was sent by Doctor Jordan to the U. S. National Museum as the type of the new species. One of the others was returned to Doctor Wilder as a cotype. This specimen has been examined by us and proves to be a *Porichthys*, probably *greenei*. The third specimen (numbered 1555?) can not be found unless the one sent us from the Indiana University is the same, in which case it should be recorded as Panama, Coll. Newcomb, instead of Punta Arenas, Coll. S. E. Meek.

(In reply to our request for information as to whether he had collected fishes in Costa Rica as indicated on the original label sent with the Indiana University specimen, we have the following letter from Doctor Meek:

"When I went to Cornell University in 1885 I found there some fishes which I was sure were new. I sent them to Doctor Jordan and he wrote me it was a species he had described but type and description were burned in the fire at Indiana University in 1883. I sent him the data and he described the species. I did not collect the specimens and know no more about them. It is quite certain the fishes in question were collected by Doctor Newcomb at Punta Arenas, Costa Rica.

"(Signed) S. E. MECK.

"(CHICAGO, ILL., May 9, 1910.)"

Doctor Wilder had a third specimen, No. 2100, which he did not send to Doctor Jordan.

Measurements of nine specimens of Thalassophryne dowi.

[If less than nine specimens were measured, the exact number is indicated in parentheses.]

	Maximum.	Minimum.	Average.	
Total length.....	15.6 cm.	.....	11.7 cm. (8)	
Standard length.....	13.6 cm.	3.9 cm.	9.5 cm.	
Body:				
Depth.....	.206	.155	.189	5.29 in standard length.
Width.....	.177	.141	.168	6.33 in standard length.
Depth at ventrals.....	.172	.149	.161	6.21 in standard length.
Depth of caudal peduncle.....	.063	.053	.056	5.11 in head.
Head:				
Length.....	.316	.264	.286	3.50 in standard length.
Width.....	.240	.192	.221	4.52 in standard length.
Interorbital width.....	.089	.055	.063	4.54 in head.
Snout.....	.041	.027	.032	8.93 in head.
Maxillary.....	.125	.110	.117	8.55 in standard length.
Mandible.....	.162	.143	.157	6.37 in standard length.
Orbit.....	.039	.018	.026	1.83 in head.
Dorsal (spinous):				
Distance from snout.....	.280	.248	.262	3.82 in standard length.
Length of base.....	.104	.071	.095	3.01 in head.
Height of first spine.....	.091	.063	.078	3.67 in head.
Height of second spine.....	.098	.081	.088	3.25 in head.
Dorsal (soft):				
Distance from snout.....	.393	.359	.378	2.65 in standard length.
Length of base.....	.641	.607	.622	1.61 in standard length.
Height of first ray.....	.082	.048	.070 (8)	4.09 in head.
Height of longest ray.....	.178	.115	.139 (8)	2.06 in head.
Height of last ray.....	.178	.155	.168 (8)	3.25 in head.
Anal:				
Distance from snout.....	.411	.384	.391	2.56 in standard length.
Length of base.....	.616	.589	.609	1.64 in standard length.
Height of first ray.....	.060	.037	.048 (8)	5.96 in head.
Height of longest ray.....	.095	.059	.077 (8)	3.71 in head.
Height of last ray.....	.063	.044	.057 (8)	5.02 in head.
Caudal:				
Length of middle rays.....	.161	.137	.152 (8)	1.88 in head.
Length of outer rays.....	.125	.051	.093 (4)	3.08 in head.
Pectoral:				
Distance from snout.....	.303	.266	.286	3.50 in standard length.
Length.....	.214	.177	.193	5.18 in standard length.
Ventral:				
Distance from snout.....	.194	.161	.179	1.48 in head.
Length.....	.143	.103	.123	5.59 in standard length.
Branchiostegals.....	6	6	6	8.13 in standard length.
Dorsal.....	II-33	II-29	II-31	2.33 in head.
Anal.....	33	29	30	
Caudal.....	16	13	14	
Pectoral.....	18	16	17 (8)	
Ventral.....	12	12	12	

THALASSOPHYRNE AMAZONICA Steindachner.

Thalassophryne amazonica STEINDACHNER, Sitzungsab. kais. Akad. Wiss. Wien., vol. 74, pt. 1, June-Dec., 1876, p. 161.

Thalassophryne amazonica MEEK and HALL, Proc. Acad. Nat. Sci. Phila., 1885, p. 54.

Head 3½. D. II-20. A. 18. P. 13-14. V. I, 2.

Body rather elongate. Head rather narrow, 1½ longer than wide. Eyes small. Snout less than interorbital width. Interorbital width twice eye. Opercular spine long and slender. Mouth oblique, the lower jaw prominent. Teeth conic, more or less blunt, smallest in

premaxillary and largest on vomer. The teeth are uniserial, except near the symphysis of the mandible, where they are in two rows. Pectoral long and pointed, reaching third or fourth anal ray. Last rays of dorsal and anal fully joined to the caudal as in *Thalassophryne dowi*.

Color bright brown with spots and marblings of darker. Two faint dark cross bands on head. Five (or six?) dark cross bands on body; the first covering the spinous dorsal, the other four (or five?) along the soft dorsal. The dark brown spots form irregular rows on the dorsal, anal and pectoral fins.

We have not been able to examine any specimens of this species and know it only from Steindachner's original description which was apparently based on three or more specimens.

THALASSOPHRYNE PUNCTATA Steindachner.

Thalassophryne punctata STEINDACHNER, Sitzungsab. kais. Akad. Wiss. Wien., vol. 74, pt. 1, June-Dec., 1876, p. 169.

Thalassophryne punctata MEEK and HALL, Proc. Acad. Nat. Sci. Phila., 1885, p. 54.

Head $2\frac{3}{4}$ to $2\frac{7}{8}$. Depth $3\frac{1}{4}$ to 4. D. II-20 to 21. A. 19. P. 15. V. I, 2. C. 14 to 15.

Body short and thick, compressed behind. Head low and broad, the length and width about equal. Eyes very small, $1\frac{1}{2}$ to $1\frac{1}{4}$ in snout and $2\frac{1}{4}$ to $2\frac{1}{2}$ in interorbital width, 11 to 12 in head. Interorbital width 5 in head (4 according to Steindachner). Opercular spine about 3 in head. Mouth nearly vertical, the lower jaw much projecting. Maxillary 2 to $2\frac{1}{4}$ in head, reaching behind eye. Mandible $1\frac{1}{2}$ in head. Teeth small, conic, with the tips slightly flattened; in two rows near symphysis of mandible, in a very narrow band on premaxillary, in a narrow patch across head of vomer, elsewhere uniserial. Pectoral fins obliquely rounded, reaching to about fifth or sixth anal ray, $1\frac{1}{2}$ to $1\frac{1}{4}$ in head. Caudal strongly rounded. The fin membrane behind the last dorsal and anal rays just reaches the base of the caudal rays.

Color in alcohol: Above brown, below dirty white, the fins all margined with dark brown, shading to the body color at the base of the fin, the anal, ventral and lower rays of the pectoral with small white tips. A very narrow yellowish tip to caudal. The upper surface of the body and all the fins, except the anal and ventrals, thickly covered with small round black spots, some of which are as large as the eye, the others smaller.



FIG. 5.—TOOTH OF *THALASSOPHRYNE PUNCTATA*.
X 16 DIAMETERS. FISH,
15.2 CM. LONG.

We have examined two specimens of this species, as follows:

No. 4632, Mus. Comp. Zoöl., Porto Seguro, Brazil. Coll. Hartt and Copeland, Thayer Expedition. One specimen, 16.3 cm. long. Cotype of *Thalassophryne punctata*.

No. 12725, Mus. Comp. Zoöl., Bahia, Brazil. Coll. C. F. Hartt, 1867. One specimen, 15.2 cm. long.

Measurements of two specimens of Thalassophryne punctata.

	No. 12725, Mus. Comp. Zoöl.	No. 4632, Mus. Comp. Zoöl. (cotype).
Total length.....	15.2 cm.....	16.3 cm.
Standard length.....	12.7 cm.....	13.1 cm.
Body:		
Depth.....	.244 4.10 in standard length.	.267 3.75 in standard length.
Width.....	.244 4.10 in standard length.	.267 3.75 in standard length.
Depth at ventral fins.....	.189 5.29 in standard length.	.198 5.05 in standard length.
Depth of caudal peduncle.....	.087 4.07 in head.	.099 3.67 in head.
Head:		
Length.....	.354 2.82 in standard length.	.366 2.73 in standard length.
Width.....	.346 2.89 in standard length.	.359 2.79 in standard length.
Interorbital width.....	.071 5.00 in head.	.076 4.8 in head.
Length of snout.....	.043 8.24 in head.	.042 8.72 in head.
Length of maxillary.....	.157 6.33 in standard length.	.175 5.71 in standard length.
Length of mandible.....	.236 4.24 in standard length.	.244 4.10 in standard length.
Diameter of orbit.....	.029 12.2 in head.	.034 10.8 in head.
Dorsal (spinous):		
Distance from snout.....	.354 2.82 in standard length.	.305 3.28 in standard length.
Length of base.....	.079 4.48 in head.	.122 3.00 in head.
Height at first spine.....	.063 5.63 in head.	.076 4.82 in head.
Height at second spine.....	.079 4.48 in head.	.076 4.82 in head.
Dorsal (soft):		
Distance from snout.....	.449 2.23 in standard length.	.458 2.18 in standard length.
Length of base.....	.551 1.81 in standard length.	.542 1.85 in standard length.
Height at first ray.....	.118 3.00 in head.	.130 2.82 in head.
Height at longest ray.....	.165 2.14 in head.	.183 2.02 in head.
Height at last ray.....	.095 3.72 in head.	.114 3.21 in head.
Anal:		
Distance from snout.....	.519 1.93 in standard length.	.495 2.02 in standard length.
Length of base.....	.481 2.08 in standard length.	.505 1.98 in standard length.
Height at first ray.....	.071 5.00 in head.	.069 5.30 in head.
Height at longest ray.....	.142 2.50 in head.	.130 2.82 in head.
Height at last ray.....	.087 4.07 in head.	.099 3.67 in head.
Caudal:		
Length of middle rays.....	.197 1.80 in head.	.244 2.00 in head.
Length of outer rays.....	.126 2.81 in head.	.092 3.98 in head.
Pectoral:		
Distance from snout.....	.370 2.70 in standard length.	.382 2.62 in standard length.
Length.....	.268 3.73 in standard length.	.244 4.10 in standard length.
Length.....	1.3 in head.	1.5 in head.
Ventral:		
Distance from snout.....	.228 4.39 in standard length.	.239 4.18 in standard length.
Length.....	.165 6.06 in standard length.	.191 5.24 in standard length.
Length.....	2.54 in head.	1.92 in head.
Branchiostegals.....	6.....	6.
Dorsal.....	11-21.....	11-20.
Anal.....	19.....	19.
Caudal.....	14.....	15.
Pectoral.....	15.....	15.
Ventral.....	1, 2.....	1, 2.

THALASSOPHRYNE MACULOSA Günther.

Thalassophryne maculosa GÜNTHER, Cat. Fish. Brit. Mus., vol. 3, p. 175, 1861.

Thalassophryne maculosa GÜNTHER, Trans. Zool. Soc. London, vol. 6, 1865, p. 436, pl. 68.

Thalassophryne nattereri STEINDACHNER, Sitzungsab. kais. Akad. Wiss. Wien., vol. 74, pt. 1, June-Dec., 1876, p. 163.

Thalassophryne maculosa and *Thalassophryne nattereri* MEEK and HALL, Proc. Acad. Nat. Sci. Phila., 1885, pp. 53-54.

Thalassophryne maculosa JORDAN and EVERMANN, Bull. 47, U. S. Nat. Mus., vol. 3, p. 2324.

Head $2\frac{1}{2}$ to 3. Depth $3\frac{1}{2}$ to 4. D. II-20. A. 19. P. 14 to 16. V. I, 2. C. 14 to 15.

Body short and thick, compressed behind. Head low, about as long as broad. Eyes very small, less than snout, about half interorbital width, $9\frac{1}{2}$ to 12 in head. Interorbital width $4\frac{1}{2}$ to $5\frac{1}{2}$ in head. Opercular spine about 3 in head. Mouth oblique, the lower jaw much projecting. Maxillary $2\frac{1}{2}$ to $2\frac{1}{2}$ in head, reaching behind eye. Mandible $1\frac{1}{2}$ to $1\frac{1}{2}$ in head. Teeth moderate, largest on palatines, in two rows on front of mandible, in a very narrow band on premaxillary, elsewhere uniserial. The teeth are rather bluntly conical and somewhat flattened at tip. Pectoral fins obliquely rounded, $1\frac{1}{2}$ to $1\frac{1}{2}$ in head, reaching about to sixth anal ray. Caudal rounded. The membrane from the last rays of dorsal and anal reaches to about the middle of the outer caudal rays in one specimen, to the base of these rays in others.

Color in alcohol: Brownish above, becoming abruptly white below in the cotype of *Thalassophryne nattereri*. In this specimen, as in one other which we have examined, the fins are all margined with white, below which is a dark band which is darker than the color of the back. In the third specimen examined the dorsal lacks the white margin and the color is much darker, practically as described for *Thalassophryne maculosa*.



a



b

FIG. 6.—TOOTH OF *THALASSOPHRYNE MACULOSA*.
X 16 DIAMETERS. FISH, 16 CM. LONG.

We can find no characters which will separate

Thalassophryne maculosa Günther and *Thalassophryne nattereri* Steindachner. In the original descriptions they are separated by the color and by the supposed fact that one had one more ray in dorsal and anal than the other. In our examination we find that the cotype of *Thalassophryne nattereri* has the fin count of *Thalassophryne maculosa*, while another specimen very similar to the cotype and one intermediate in coloration or nearer to *Thalassophryne maculosa* have the number of rays assigned to *T. nattereri*.

We have examined three specimens of this species, as follows:

No. 12726, Mus. Comp. Zool., Para, Brazil. Coll. L. Agassiz, Thayer Expedition. One specimen 10.6 cm. long. Cotype of *Thalassophryne nattereri*.

No. 12724, Mus. Comp. Zool., Curuca, Brazil, a small place on the coast just south of the mouth of the Amazons. Coll. L. Agassiz, Thayer Expedition. Two specimens, 13.7 cm. long and 16 cm. long.

Measurements of three specimens of *Thalassophryne maculosa*.

	No. 12726, Mus. Comp. Zöbl. (cotype of <i>Thalassophryne nattereri</i>).	No. 12724, Mus. Comp. Zöbl.	No. 12724, Mus. Comp. Zöbl.
Total length.....	10.6 cm	13.7 cm	16.0 cm.
Standard length.....	8.5 cm	11.1 cm	13.1 cm.
Body:			
Depth.....	.282 3.55 in standard length.	.251 3.98 in standard length.	.252 3.97 in standard length.
Width.....	.259 3.86 in standard length.	.279 3.58 in standard length.	.275 3.64 in standard length.
Depth at ventral fins.	.212 4.72 in standard length.	.189 5.29 in standard length.	.191 5.24 in standard length.
Depth of caudal peduncle.	.094 4.12 in head	.081 4.11 in head	.099 3.67 in head.
Head:			
Length.....	.387 2.58 in standard length.	.333 3.0 in standard length.	.366 2.73 in standard length.
Width.....	.341 2.98 in standard length.	.351 2.85 in standard length.	.366 2.73 in standard length.
Interorbital width.....	.071 5.4 in head	.063 5.3 in head	.080 4.6 in head.
Length of snout.....	.047 8.24 in head	.041 8.13 in head	.038 9.63 in head.
Length of maxillary.....	.176 5.68 in standard length.	.135 7.41 in standard length.	.160 6.25 in standard length.
Length of mandible ..	.235 4.26 in standard length.	.225 4.44 in standard length.	.236 4.24 in standard length.
Diameter of orbit.....	.041 9.4 in head	.027 12.3 in head	.031 11.8 in head.
Dorsal (spinous):			
Distance from snout...	.318 3.14 in standard length.	.270 3.71 in standard length.	.298 3.36 in standard length.
Length of base.....	.129 3.00 in head	.117 2.84 in head	.107 3.42 in head.
Height at first spine ..	.094 4.12 in head	.090 3.70 in head	.092 3.98 in head.
Height at second spine	.106 3.65 in head	.108 3.08 in head	.099 3.67 in head.
Dorsal (soft):			
Distance from snout...	.470 2.13 in standard length.	.459 2.18 in standard length.	.412 2.43 in standard length.
Length of base.....	.530 1.89 in standard length.	.541 1.85 in standard length.	.588 1.70 in standard length.
Height at first ray ..	.153 2.53 in head	.135 2.46 in head	.107 3.42 in head.
Height at longest ray ..	.176 2.20 in head	.180 1.85 in head	.168 2.18 in head.
Height at last ray ..	.106 3.65 in head	.099 3.33 in head	.099 3.67 in head.
Anal:			
Distance from snout...	.494 2.02 in standard length.	.459 2.18 in standard length.	.495 2.02 in standard length.
Length of base.....	.506 1.98 in standard length.	.541 1.85 in standard length.	.506 1.98 in standard length.
Height at first ray ..	.062 4.72 in head	.072 4.63 in head	.069 5.30 in head.
Height at longest ray ..	.153 2.53 in head	.135 2.46 in head	.122 3.00 in head.
Height at last ray ..	.094 4.12 in head	.090 3.70 in head	.092 3.98 in head.
Caudal:			
Length of middle rays.	.247 1.57 in head	.234 1.44 in head	.221 1.66 in head.
Length of outer rays ..	.129 3.00 in head	.045 7.40 in head	.076 4.82 in head.
Pectoral:			
Distance from snout...	.377 2.65 in standard length.	.333 3.00 in standard length.	.390 2.56 in standard length.
Length.....	.282 3.55 in standard length.	.252 3.97 in standard length.	.259 3.86 in standard length.
1.4 in head.		1.3 in head.	1.4 in head.
Ventral:			
Distance from snout...	.188 5.32 in standard length.	.189 5.29 in standard length.	.244 4.10 in standard length.
Length.....	.200 5.00 in standard length.	.162 6.17 in standard length.	.153 6.54 in standard length.
1.94 in head.		2.03 in head.	2.39 in head.
Branchiostegals.....	6	6	6
Dorsal.....	11-20	11-20	11-20.
Anal.....	19	19	19.
Caudal.....	14	15	14.
Pectoral.....	14	16	17.
Ventral.....	1, 2	1, 2	1, 2.

THALASSOPHYRNE RETICULATA Günther.

Thalassophyrne reticulata GÜNTHER, Proc. Zool. Soc. London, 1864, pp. 150 and 155.

Thalassophyrne reticulata GÜNTHER, Trans. Zool. Soc. London, vol. 6, 1868, p. 437, pl. 68.

Thalassophyrne reticulata MEEK and HALL, Proc. Acad. Nat. Sci. Phila., 1885, pp. 54 and 55.

Thalassophyrne reticulata SAVTSCHENKO, Atlas des Poissons Vénéneux, 1886, p. 39, pl. 10, fig. 1.

Thalassophyrne reticulata JORDAN and EVERMANN, Bull. 47, U. S. Nat. Mus., vol. 3, p. 2325, November 26, 1898.

Thalassophyrne reticulata GILBERT and STARKS, Mem. California Acad. Nat. Sci., vol. 6, 1904, p. 186.

Head 3. Depth $5\frac{1}{2}$. D. II-27. A. 25. P. 17. V. I, 2. C. 12.

Body moderately elongate, compressed behind. Head low, the width slightly less than the length, the difference about equal to length of orbit. Eyes small, a little less than snout and 1.7 in interorbital space, $8\frac{1}{2}$ in head. Interorbital width 5 in head. Opercular

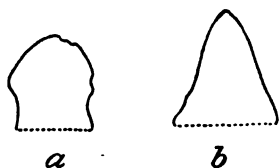


FIG. 7.—TOOTH OF THALASSOPHYRNE RETICULATA. $\times 16$ DIAMETERS. FISH, 26.7 CM. LONG.

spine $3\frac{1}{2}$ to 5 in head. Mouth nearly vertical, the lower jaw very prominent. Maxillary $2\frac{1}{2}$ in head, reaching behind eye. Mandible $1\frac{1}{2}$ in head. Teeth rather short, conic incisors, oval in front view, with a long cutting edge extending nearly around the exposed part of the tooth, uniserial in mandible, premaxillary, vomer, and palatines, except that near the symphysis of the mandible

and near the front of the premaxillary the teeth are crowded so as to appear in two very irregular rows or a narrow cardiform band. There are no teeth on the shaft of the vomer, the single row of teeth on that bone being a direct continuation of the row on the palatines. There is no indication of a tendency to form canines in fish of any size. Pectoral fins obliquely rounded, $1\frac{1}{2}$ in head, reaching to about sixth or seventh anal ray (eighth in the smallest specimen). Caudal rounded except in the smallest specimen, where it has the upper and lower rays (one upper and one lower ray) much produced, the middle rays $1\frac{1}{2}$ in length of outer ones. The fin membrane behind the last dorsal and anal rays just reaches to the base of the caudal rays.

Color in alcohol dark gray with a conspicuous reticulation of grayish white lines above, grayish white below. The spinous dorsal is black. All the other fins are colored like the back and edged with white. Whole mandibular region colored like the back, but with finer reticulations.

We have examined five specimens of this species, as follows:

No. 6874, Leland Stanford, Jr., University Museum, Panama. Coll. C. H. Gilbert. Four specimens, 6.6 cm., 20.9 cm., 24.2 cm., and 26.7 cm. long.

No. 50409, U. S. Nat. Mus., Panama. Coll. C. H. Gilbert. One specimen, 29.7 cm. long.

Measurements of five specimens of Thalassophryne reticulata.

	Maximum.	Minimum.	Average.	
Total length.....	29.7 cm.	6.6 cm.	21.6 cm.	
Standard length.....	24.8 cm.	5.5 cm.	18.0 cm.	
Body:				
Depth.....	.198	.164	.185	5.41 in standard length.
Width.....	.222	.198	.210	4.77 in standard length.
Depth at ventral fins.....	.169	.157	.165	6.06 in standard length.
Depth of caudal peduncle.....	.073	.069	.064	5.12 in head.
Head:				
Length.....	.331	.323	.327	3.06 in standard length.
Width.....	.320	.297	.308	3.28 in standard length.
Interorbital width.....	.076	.068	.066	4.96 in head.
Snout.....	.045	.035	.041	7.98 in head.
Maxillary.....	.153	.144	.148	6.76 in standard length.
Mandible.....	.202	.192	.197	2.21 in head.
Orbit.....	.055	.028	.038	5.08 in standard length.
Dorsal (spinous):				
Distance from snout.....	.296	.255	.279	1.66 in head.
Length of base.....	.116	.081	.102	8.61 in head.
Height of first spine.....	.109	.076	.092	3.58 in standard length.
Height of second spine.....	.099	.073	.086	3.21 in head.
Dorsal (soft):				
Distance from snout.....	.442	.382	.421	3.56 in head.
Length of base.....	.618	.558	.579	3.80 in head.
Height of first ray.....	.104	.081	.093	2.37 in standard length.
Height of longest ray.....	.182	.129	.147	1.73 in standard length.
Height of last ray.....	.109	.079	.094	3.32 in head.
Anal:				
Distance from snout.....	.455	.418	.444	2.22 in head.
Length of base.....	.582	.545	.566	3.48 in head.
Height of first ray.....	.091	.049	.061	2.25 in standard length.
Height of longest ray.....	.127	.099	.112	1.80 in standard length.
Height of last ray.....	.091	.069	.077	5.37 in head.
Caudal:				
Length of middle rays.....	.215	.127	.187	2.92 in head.
Length of outer rays.....	.200	.141	.161	4.25 in head.
Pectoral:				
Distance from snout.....	.380	.327	.343	1.75 in head.
Length.....	.309	.222	.246	2.03 in head.
Ventral:				
Distance from snout.....	.202	.164	.186	2.91 in standard length.
Length.....	.200	.145	.165	4.07 in standard length.
Branchiostegals.....	5	5	5	1.33 in head.
Dorsal.....	II-27	II-26	II-27	
Anal.....	25	25	25	
Caudal.....	12	10	12	
Pectoral.....	17	17	17	
Ventral.....	I, 2	I, 2	I, 2	

THALASSOPHYRNE MEGALOPS Bean and Weed, new species.

Head $2\frac{1}{2}$ to $2\frac{3}{4}$. Depth $3\frac{1}{4}$. D. II-18 or 19. A. 17. P. 13 to 14. V. I, 2. C. 14.

Body short and stout, compressed behind. Head low, its length slightly greater (one-seventh to two-ninths) than its width. Eyes large, $5\frac{1}{2}$ to $5\frac{1}{4}$ in head. Eyes $1\frac{1}{2}$ to $1\frac{1}{4}$ times length of snout, equal to interorbital width. Interorbital width 5.3 to 5.5 in length of head.

Opercular spine $3\frac{1}{4}$ to 4 in head. Mouth oblique, the lower jaw much projecting. Maxillary 2 in head, reaching past eye. Mandible $1\frac{1}{2}$ in head. Teeth broad incisors, uniserial on premaxillary,

mandible, vomer and palatines. The illustration shows the front and side of a tooth from the left palatine. Pectoral fins obliquely rounded, reaching to about fourth anal ray, $1\frac{1}{2}$ in head. Caudal



FIG. 8.—TOOTH OF THALASSOPHYRNE MEGALOPS. $\times 16$ DIAMETERS. FISH, 6.9 CM. LONG.

rounded. Fin membrane from last rays of dorsal and anal reaching to base of caudal rays.

The color is entirely lost in our specimens with the exception of a small dark spot at the top of the spinous dorsal.

Thalassophryne megalops differs from the other species of the genus in the very large eye and in the large, broad incisor teeth, which are proportionally two or three times as broad as in the other species.

We have examined and measured two specimens, the larger the type, both of them No. 37669, U. S. Nat. Mus., from fisheries steamer *Albatross*, station 2142, in the Gulf of Darien, at a depth of 42 fathoms. Taken March 29, 1884. The specimens are 5.4 cm. and 6.9 cm. long, respectively.

Measurements of the type and cotype of Thalassophryne megalops.

	Cotype, No. 37669, U. S. Nat. Mus.	Type, No. 37669, U. S. Nat. Mus.
Total length.....	5.4 cm.	6.9 cm.
Standard length.....	4.3 cm.	5.5 cm.
Body:		
Depth.....	.279 3.58 in standard length.	.291 3.44 in standard length.
Width.....	.256 3.91 in standard length.	.291 3.44 in standard length.
Depth at ventral fins.....	.209 4.79 in standard length.	.200 5.00 in standard length.
Depth of caudal peduncle.....	.106 3.54 in head.	.096 4.17 in head.
Head:		
Length.....	.372 2.69 in standard length.	.400 2.50 in standard length.
Width.....	.326 3.07 in standard length.	.327 3.06 in standard length.
Interorbital width.....	.070 5.3 in head.	.073 5.5 in head.
Length of snout.....	.047 7.92 in head.	.055 7.27 in head.
Length of maxillary.....	.186 5.35 in standard length.	.182 5.49 in standard length.
Do.....	2.0 in head.	2.2 in head.
Do.....	.233 4.29 in standard length.	.255 3.92 in standard length.
Do.....	1.6 in head.	1.6 in head.
Diameter of orbit.....	.070 5.3 in head.	.073 5.5 in head.
Dorsal (spinous):		
Distance from snout.....	.337 2.97 in standard length.	.364 2.75 in standard length.
Length of base.....	.116 3.20 in head.	.100 4.00 in head.
Height at first spine.....	.139 2.68 in head.	.109 3.76 in head.
Height at second spine.....	.116 3.20 in head.	.127 3.14 in head.
Dorsal (soft):		
Distance from snout.....	.465 2.15 in standard length.	.491 2.04 in standard length.
Length of base.....	.535 1.87 in standard length.	.509 1.96 in standard length.
Height at first ray.....	.116 3.20 in head.	.109 3.76 in head.
Height at longest ray.....	.174 2.14 in head.	.145 2.76 in head.
Height at last ray.....	.070 5.32 in head.	.062 4.88 in head.
Anal:		
Distance from snout.....	.512 1.95 in standard length.	.509 1.96 in standard length.
Length of base.....	.488 2.05 in standard length.	.491 2.04 in standard length.
Height at first ray.....	.093 4.00 in head.	.073 5.48 in head.
Height at longest ray.....	.116 3.20 in head.	.136 2.94 in head.
Height at last ray.....	.093 4.00 in head.	.100 4.00 in head.
Caudal:		
Length of middle rays.....	.256 1.45 in head.	.255 1.57 in head.
Length of outer rays.....	.163 2.28 in head.	.136 2.94 in head.
Pectoral:		
Distance from snout.....	.396 2.53 in standard length.	.400 2.50 in standard length.
Length.....	.256 3.91 in standard length.	.291 3.44 in standard length.
Do.....	1.41 in head.	1.37 in head.
Ventral:		
Distance from snout.....	.233 4.29 in standard length.	.255 3.92 in standard length.
Length.....	.163 6.13 in standard length.	.200 5.00 in standard length.
Do.....	2.28 in head.	2.00 in head.
Branchiostegals.....	5.	6.
Dorsal.....	11-19.	11-18.
Anal.....	17.	17.
Caudal.....	14.	14.
Pectoral.....	13.	14.
Ventral.....	1, 2.	1, 2.

Genus THALASSOTHIA Berg.

Thalassophryne BERG, An. Mus. La Plata, Zool., vol. 1, 1893, p. 6, pl. 2.

Thalassothia BERG, An. Mus. Nac. Buenos Aires, vol. 4 (ser. 2, vol. 1), 1895, p. 66, pl. 1.

Thalassothia OGILBY, Ann. Queensland Mus., no. 9, pt. 2, 1908, pp. 46 and 54.

Dorsal spines four, the first two perforated for the passage of a venom duct, as in *Thalassophryne*.

Operculum developed as a strong spine which is hollow, like the first dorsal spines.

Teeth blunt conic.

Gill membrane apparently much narrower than in *Porichthys*, much as in *Thalassophryne*; not reaching much beyond the end of the opercular spine.

The first two anal rays are somewhat separated from the rest of the fin.

This genus differs from *Thalassophryne* in the number of dorsal spines; in the separation of the first anal rays from the rest of the fin and probably in the rather heavier body. In the only known species the dorsal and anal fins are shorter than in any known species of *Thalassophryne*.

Thalassothia differs from *Porichthys* in the dentition; in the number of dorsal spines; in the armament of the operculum; in the width of the gill membrane and in the stouter body.

Type.—*Thalassothia montevidensis* Berg.

THALASSOTHIA MONTEVIDENSIS Berg.

Thalassophryne montevidensis BERG, An. Mus. La Plata, Zool., vol. 1, 1893, p. 6, pl. 2.

Thalassothia montevidensis BERG, An. Mus. Nac. Buenos Aires, vol. 4 (ser. 2, vol. 1), p. 67, pl. 1.

Head 3. Depth apparently about equal to length of head. D. II-II-16. A. 2, 14. V., I 2. P. 16. Body short and stout, somewhat compressed behind the origin of the dorsal. Head depressed, wider than long. Eyes very small, apparently less than snout, which is about half the interorbital space. Opercular spine short, shorter than first dorsal spines.

It is impossible from the original description ("* * * la abertura de la boca muy poco oblicuamente ascendente, pero la parte mentoniana algo prominente, redondeada é inferiormente provista de pequeños lóbulos * * *," the aperture of the mouth little obliquely ascending, but the chin somewhat prominent, rounded, and provided below with small lobules) to be sure whether the mouth is nearly horizontal or nearly vertical, but from an examination of the illustration and from the fact that the eyes are said to be directed upward and forward ("* * * hacia arriba y adelante; * * *") it seems

probable that the mouth is more nearly horizontal than in *Thalassophryne*. The further description of the mouth as wide and almost transverse ("La boca es muy ancha y casi transversal"), taken in connection with the broad snout, is of little value in this connection. The maxillary apparently reaches somewhat beyond eye. The teeth are conic and obtuse, uniserial in mandible and premaxillary; those of the mandible and premaxillary described as pointing inward while those of the maxillary point outward. ("Los dientes son cónicos y obtusos, formando una serie en el premaxilar, y una en la mandíbula; los de la mandíbula y del premaxilar son dirigidos hacia adentro, y los del maxilar hacia afuera.") There are no teeth on the maxillary in *Thalassophryne*. The pectorals are obliquely rounded and reach past the base of the dorsal and anal. Dorsal and anal well separated from the base of the caudal. Caudal somewhat rounded.

Color yellowish or yellowish brown marbled with blackish and with three wide blackish cross bands along the base of the soft dorsal. The color fades to a dirty white below.

The type of the species was taken at Montevideo; later another one was seen at the same place, and Berg reports that the fishermen claim to have seen many of them at Maldonado.

We have no knowledge of this species further than the descriptions furnished by Berg.

EXPLANATION OF PLATES.

PLATE 31.

Thalassophryne dowi, copied from Proc. Cal. Acad. Sci., ser. 2, vol. 6, 1896, pl. 38.

PLATE 32.

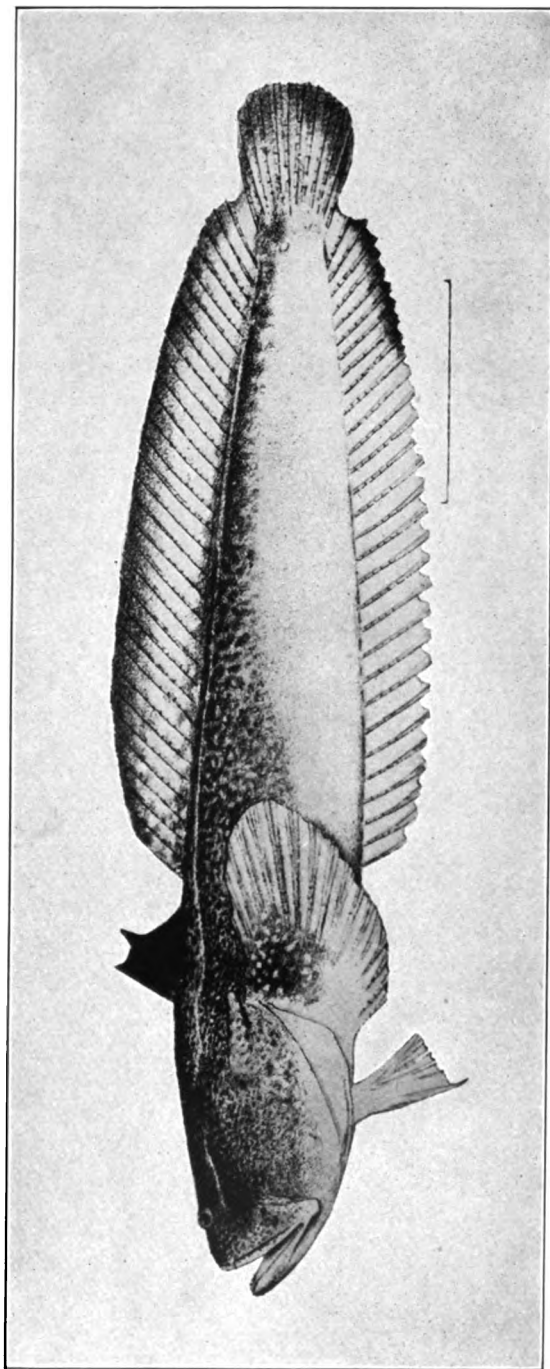
- Fig. 1. *Thalassophryne punctata*, drawing by Miss Evelyn Mitchell from cotype No. 4632, Mus. Comp. Zool., Porto Seguro, Brazil. Coll. C. F. Hartt and E. Copeland, Thayer Expedition.
2. *Thalassophryne maculosa*, drawing by Miss Violet Dandridge from cotype of *Thalassophryne nattereri*, No. 12726, Mus. Comp. Zool., Para, Brazil. Coll. L. Agassiz, Thayer Expedition.
3. Photograph of opercular spine of *Thalassophryne dowi* No. 41430, U. S. N. M., Panama. Coll. Str. Albatross.
4. Photograph of opercular spine of *Porichthys greeniei*, cotype of *Thalassophryne dowi*.

PLATE 33.

Thalassophryne maculosa, copied from Trans. Zool. Soc. London, vol. 6, pl. 68.

PLATE 34.

Thalassophryne reticulata, copied from Trans. Zool. Soc. London, vol. 6, pl. 68.



THALASSOPHRYNE DOWI (AFTER JORDAN).

FOR EXPLANATION OF PLATE SEE PAGE 526.

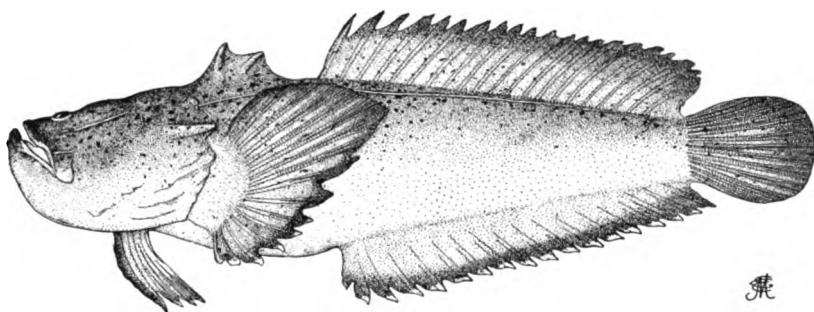


FIG. 1.—*THALASSOPHRYNE PUNCTATA*.



FIG. 3.—OPERCULAR SPINE OF
THALASSOPHRYNE DOWL.



FIG. 4.—OPERCULAR SPINE
OF *PORICHTHYS GREENEI*.

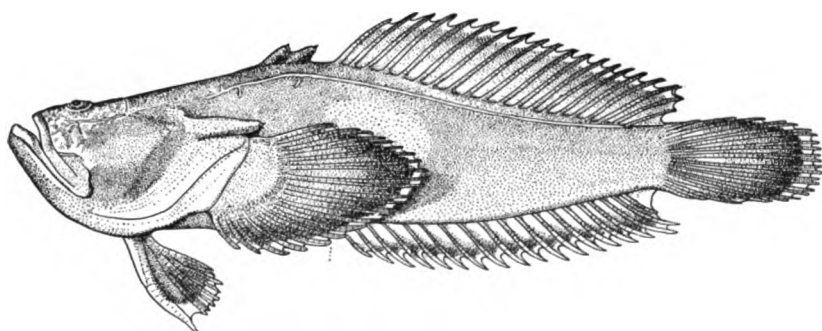
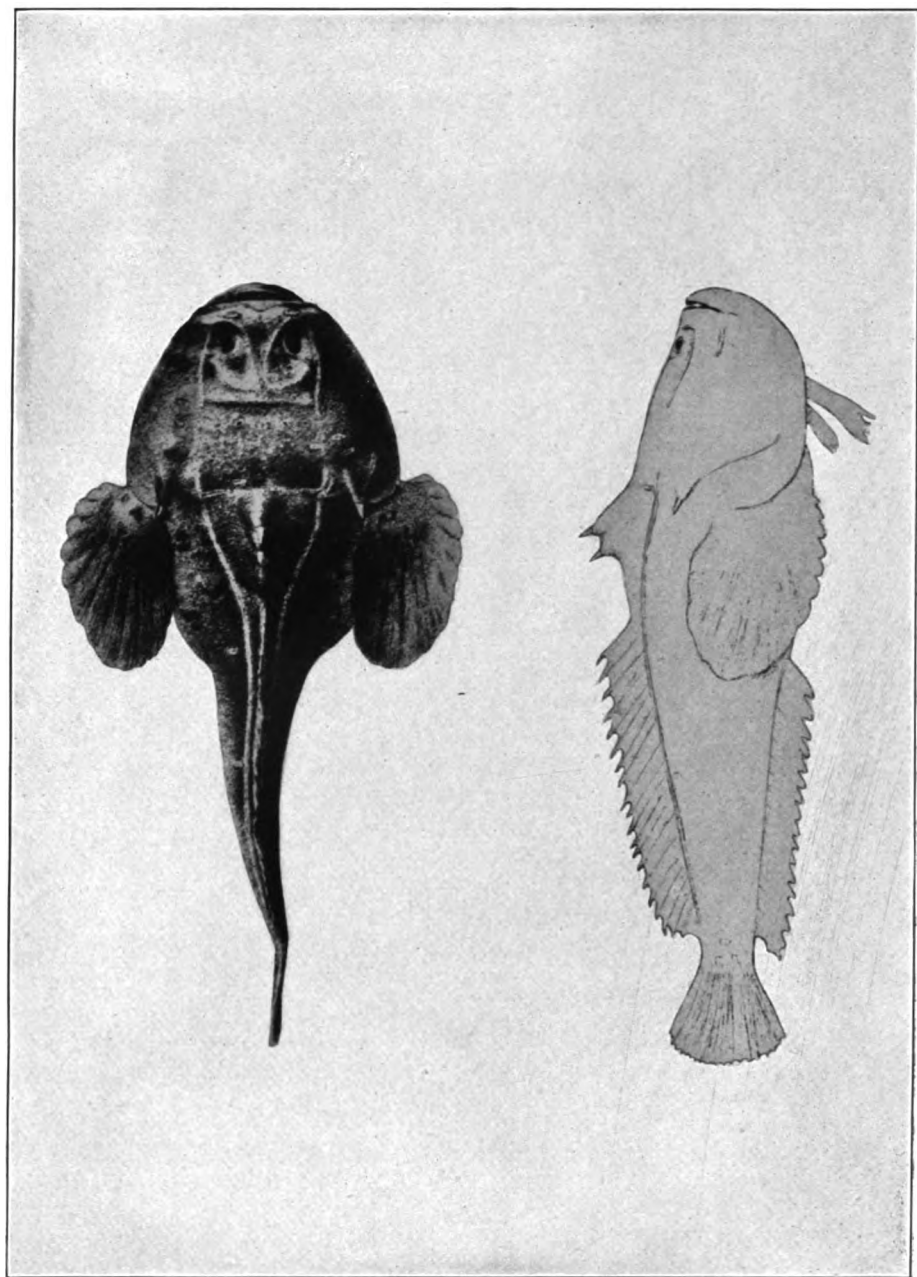


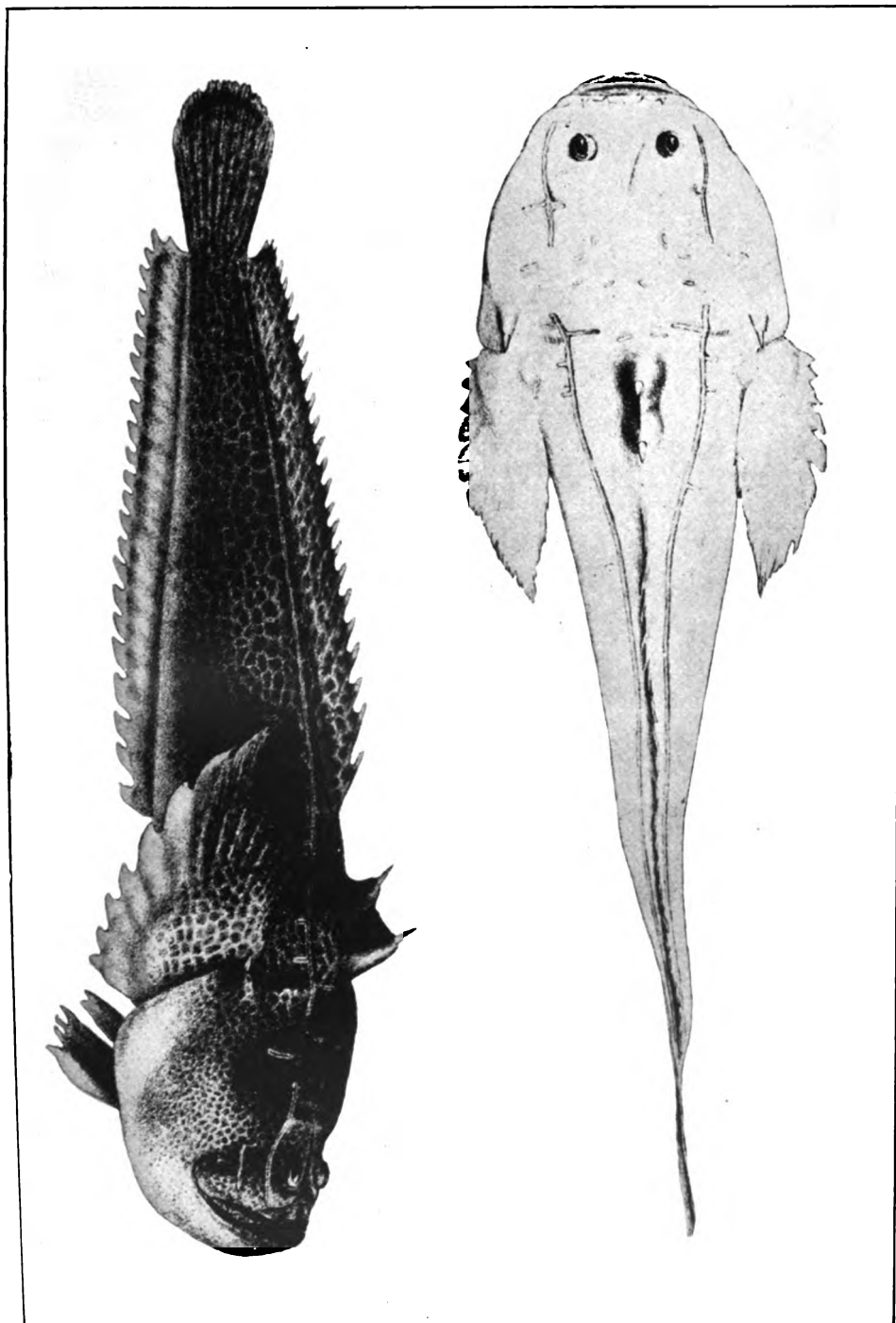
FIG. 2.—*THALASSOPHRYNE MACULOSA*, COTYPE OF *T. NATTERERI*.

FOR EXPLANATION OF PLATE SEE PAGE 526.



THALASSOPHRYNE MACULOSA (AFTER GÜNTHER).

FOR EXPLANATION OF PLATE SEE PAGE 526.



THALASSOPHYRNE RETICULATA (AFTER GÜNTHER).

FOR EXPLANATION OF PLATE SEE PAGE 526.

NEW MOTHS OF THE GENUS TRICHOSTIBAS.

By AUGUST BUSCK,
Of the U. S. Department of Agriculture.

The moths of the genus *Trichostibas* are rather common in Central and South America and are frequently taken by collectors, because they are attracted by light.

In the U. S. National Museum are good series of a dozen species of this genus, including all but one of the species described from continental America and the four new species, described in this paper.^a In addition to these, two species are described from Cuba and one from Porto Rico by Zeller; and one species is described from Jamaica^b by Lord Walsingham as *Trichostibas pallidicostella*; but if the venation of the hind wing is correctly given, this is clearly not a *Trichostibas*, as was suggested in his description.

The only species found in United States has been for several years identified as *Trichostibas calligera* Zeller,^c from Cuba; but a careful reading of Zeller's description proves this to be a groundless identification, and the Florida species must be known under its American name, *Trichostibas parvula* Edwards,^d which has hitherto wrongfully been placed as a synonym of *T. calligera* Zeller.

While the adults of this genus are thus tolerably well known, none of the larvæ have ever been described, and only a few of the species have been associated with and reared from their remarkable cocoons.

The moths of the genus are rather obscure, dull-colored insects, though with a charm of their own in their soft brown or bluish colors. Their cocoons, on the contrary, are very striking objects, rarely met with, and it is the opportunity to describe one of these and to present an adequate illustration of it, that is the main reason for the present paper.

^a There are besides these cotypes and large series of three other species of this genus, which have been described by Lord Walsingham, and which will appear in the near future in his volume of the *Biologia Central-Americani*.

^b Proc. Zool. Soc. London, 1897, p. 115.

^c Horæ Soc. Ent. Rossicæ, vol. 13, 1877, p. 231.

^d Papilio, vol. 1, 1881, p. 80.

TRICHOSTIBAS ISTHMIELLA, new species.

Labial palpi black. Tongue white. Face and head deep blackish blue. Antennæ dark blue. Thorax lighter, slaty blue. Forewings dark violet, clouded with lighter, inky, bluish violet. The color appears very nearly uniform under a lens, but in certain lights two broad, ill-defined bands of the lighter color can be made out, one at basal third, one at apical third, and the extreme tip is also somewhat lighter. Cilia dull blackish blue. Hindwings very dark, dull blackish fuscous, darker than those of any of the other described species and but very slightly transparent, just enough to distinguish the still darker veins. Abdomen deep metallic blue; ovipositor long, horny. Legs deep blue. Alar expanse, 37 mm.

Habitat.—Gorgona, Canal Zone, Panama. E. A. M. Swaine, coll.

Type.—Cat. No. 13151, U.S.N.M.

A cocoon of this species with a live pupa was received through the mails on April 16, and on the same day the moth, a female, issued.

The cocoon is of the general open network type of the genus and is apparently very similar to that of *T. fumosa* Zeller, described by Lord Walsingham.^a A picture of similar cocoons is given without identification of the species by Henry Edwards in *The Standard Natural History*, vol. 2, 1884, p. 438.

In the present species the cocoon is suspended from a leaf by a stiff, silken thread more than 13 inches long, which, like the cocoon itself, is of a bright salmon red color. This supporting thread divides into three branches at the top of the cocoon, two of which form the edge of the opening through which the moth issues, while the third is continued along the one side of the cocoon, but does not protrude beyond it as in the cocoon of our Florida species. These thick threads are evidently spun first by the larva, which, suspended on them in midair, makes the regular open network between them and around itself. The cocoon is kidney-shaped, 19 by 10 mm., and consists of heavier parallel threads about $1\frac{1}{2}$ mm. apart, connected by thinner cross threads about 1 mm. apart and underlaid by an irregular open network of very fine threads. The moth issues through the hole at the upper end; at the lower end the cocoon terminates in a short, open neck, through which the larval skin is pushed out after pupation, thus insuring a clean, airy habitation, free from anything that might become water-soaked, or by its smell attract ants, the ever present enemy of other insect life in the Tropics. The entire elaborate contrivance is presumably a very effective protection against ants during the defenseless pupa period, for even should an ant attempt to climb down the long suspending thread it would

^a Proc. Zool. Soc. London, 1897, p. 114.

probably be shaken off by the lusty violent jerks of the pupa, which were observed in the present specimen, whenever it was disturbed.

I am under obligation to Mr. T. W. Smillie of the U. S. National Museum for the life-sized photograph, which enables me to show the figure of the moth and its cocoon (Plate 35).

The species is by far the largest described in the genus and very distinct from the unicolored species, to which it comes nearest, by its size, its ornamentation, and its very dark hindwings.

***TRICHOSTIBAS CHIQUITA*, new species.**

Labial palpi bluish black. Face and head bluish or greenish black. Antennæ deep blue. Thorax greenish black. Forewings unicolored, shiny, metallic bluish or violet black; costa nearly straight, slightly convex on its outer third; apex pointed; termen oblique. Hindwings transparent, sparsely covered with dull black scales; veins black; in the males with a strong, brown hairpencil at base of costa. Abdomen bluish black; ovipositor hardly protruding; male genitalia strongly developed, with long, thin black-scaled claspers and with two expansible tufts of yellow bristles.

Alar expanse, 20–23 mm.

Habitat.—Juan Vinas, Tuis, and Florida, Costa Rica. William Schaus, coll.

Type.—Cat. No. 13152, U.S.N.M. Cotypes in British Museum.

This is the smallest of the described continental species and comes nearest to the West Indian species, described by Zeller, from which it differs by the darker forewings and by the dark brown costal hairpencil in the males.

***TRICHOSTIBAS COSTARICÆ*, new species.**

Labial palpi blackish brown. Face blackish brown. Antennæ dark metallic blue. Head light brown. Thorax light brown, with whitish apex and posterior tip. Forewings deep maroon brown, with a strong purplish sheen and with dirty, brownish white markings. These markings are poorly defined and are gradually shaded into the dark color; the costal half from base to near apex is unmottled dark brown; on the dorsal part of the wing the white predominates and contain a large oval brown spot on vein 1^b at basal third, which, by a narrow oblique brown streak, is connected with the upper dark part near the middle of the wing. From the costal dark part projects a spur downwards at apical fourth, which terminates in a nearly separated round brown spot; terminal and extreme apical part white; cilia light brown. Hindwings blackish fuscous, semitransparent except at apex; in the males with a strong, light ochreous, costal tuft. Veins 2 and 3 stalked in the males, separate in the females. This is merely an extreme case of the normal condi-

tion in all the species of the genus, where veins 2 and 3 are always closer together in the males than in the females. Abdomen and legs blackish brown. Ovipositor protruding, horny, reddish. Male claspers likewise red and horny.

Alar expanse, 30–32 mm.

Habitat.—Juan Vinas, Sixola River, and Tuis, Costa Rica. William Schaus, coll.

Type.—Cat. No. 13154, U.S.N.M. Cotype in British Museum.

Though not unicolored, this species, nevertheless, belongs nearest to the unicolored group of the genus and forms an intermediate link between this and the spotted group. The species is nearest in size and in ground-color to *hephaestiella* Zeller, from which it is at once separated by the ornamentation.

TRICHOSTIBAS VENATELLA, new species.

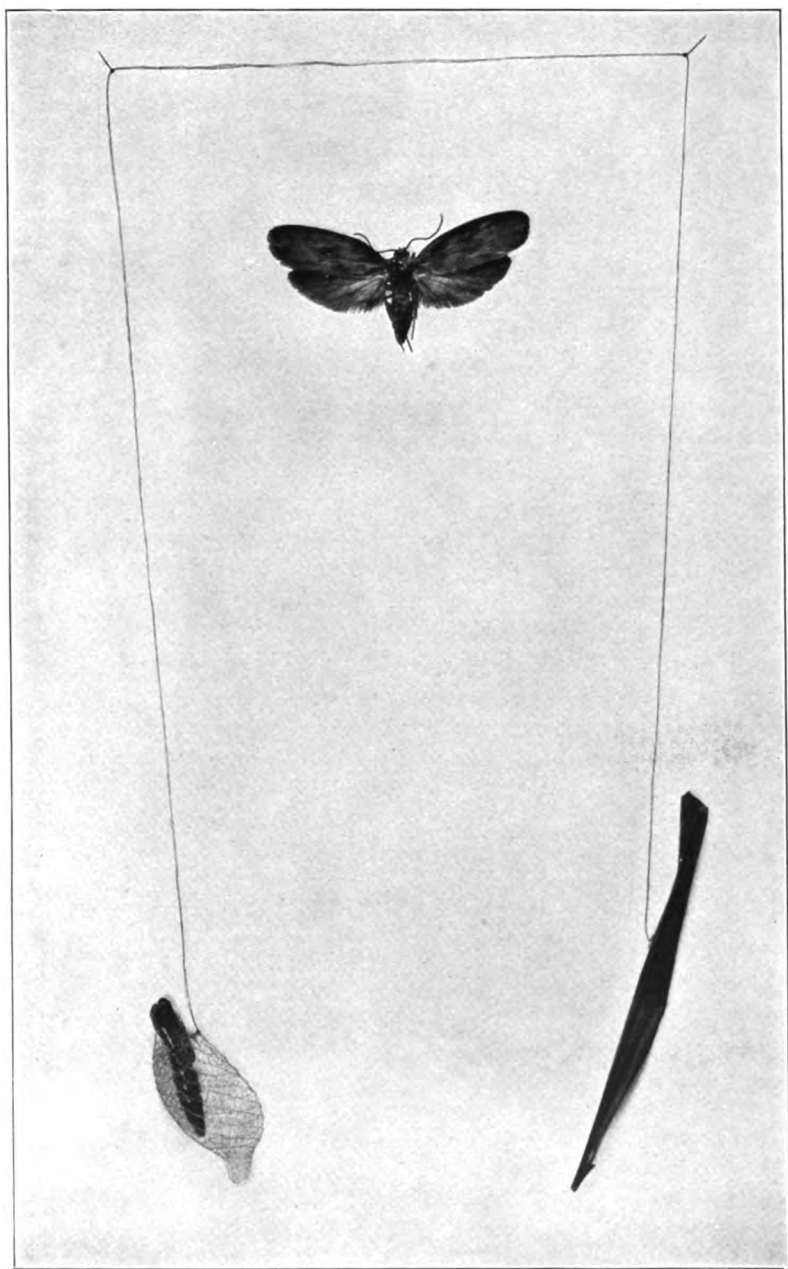
Labial palpi, face, head, and antennæ bluish black. Thorax bluish or greenish black, with two large oval white spots; patagina bluish black. Forewings blackish brown, with strong metallic blue and green sheen and with dirty white markings, as follows: across the wing near the base is a row of three irregular round white spots, an upper near to but not touching the costal edge, a lower near to but not touching the dorsal edge, and a somewhat larger central spot. Just beyond the middle of the wing is a broad band of white, broken up by the black veins into seven irregular oblong spots; one between the costal edge and vein 11; one between vein 11 and vein 10; one on the small cell cut off by the internal vein; one, the largest, on the main cell; one between this and vein 2; one between vein 2 and the fold, and one elongate pointed white spot between the latter and the dorsal edge. All the intervals between the apical and terminal veins dirty white; the veins themselves black. Entire edge of the wing narrowly black. Cilia blackish brown. Hindwing dark fuscous, but rather transparent on the basal half, more or less opaque on the outer half. Abdomen bluish black. Ovipositor horny, protruding, reddish.

Alar expanse, 30–31 mm.

Habitat.—Castro, Parana, Brazil. William Schaus, coll.

Type.—Cat. No. 13153, U.S.N.M.

This is one of the easily distinguished spotted group of species in the genus and the largest described species of that group. It is nearest to and greatly resembles *T. iophlebia* Zeller, but is larger, darker, bluish black instead of violet, and has the white portion of the wing much more restricted than Zeller's species. In this latter particular, as well as in general habitus, it is much like *T. imitans* Felder, but is a larger and darker form than that species.



TRICHOSTIBAS ISTHMIELLA.

FOR EXPLANATION OF PLATE SEE PAGE 528.

THE STALK-EYED CRUSTACEA OF PERU AND THE ADJACENT COAST.

By MARY J. RATHBUN,

Assistant Curator, Division of Marine Invertebrates, U. S. National Museum.

INTRODUCTION.

Among the collections obtained by Dr. Robert E. Coker during his investigations of the fishery resources of Peru during 1906-1908 were a large number of Crustacea, representing 80 species. It was the original intention to publish the reports on the Crustacea under one cover, but as it has not been feasible to complete them at the same time, the accounts of the barnacles ^a and isopods ^b have been issued first. There remain the decapods, which comprise the bulk of the collection, the stomatopods, and two species of amphipods. One of these, inhabiting the sea-coast, has been determined by Mr. Alfred O. Walker; the other, from Lake Titicaca, by Miss Ada L. Weckel. See papers immediately following.

Throughout this paper, the notes printed in smaller type were contributed by Doctor Coker.

One set of specimens has been returned to the Peruvian Government; the other has been given to the United States National Museum.

Economic value.—The west coast of South America supports an unusual number of species of large crabs, which form an important article of food. Various smaller kinds, when occurring in abundance, are also eaten, such as the hermit crabs and the so-called hippas or sand bugs. Two species of the latter inhabit Peru. The natives distinguish them by separate names, although carcinologists are slow to recognize their differences. The large and handsome land crab, *Ucides*, which is rare in collections, is said to be abundant in the mangrove swamps, and very palatable. The river shrimp, *Bithynis*, is one of the most abundant of the forms brought to market; it some-

^a Proc. U. S. Nat. Mus., vol. 37, no. 1700, 1909, pp. 63-74, pls. 16-19, text figs. 1-2.

^b Idem, vol. 38, no. 1729, 1910, pp. 79-85, text figs. 1-6.

times exceeds a foot in length. The rock crab, *Grapsus*, common in all tropical countries, is used for bait, as are also the hippas above mentioned.

History.—The first list of Crustacea of Peru was made by Kinahan and published in the Journal of the Royal Society of Dublin, volume 1, 1857. It comprised only those species, 24 in number, which were collected and brought home by Kinahan himself; many of the commoner forms existing on the coast were, owing to circumstances, not included. Kinahan's observations were confined to two localities, Callao Roads and the Chincha Islands. Some crabs which he reported as common are not included in the Coker collection, as *Cancer longipes*, *Panopeus crenatus*, and *Cyclograpsus cinereus*.

Aside from the above-mentioned list, our knowledge of the Crustacea is somewhat fragmentary, having been derived from the various voyages which have touched at one or more ports in Peru. It was on the voyage of the French corvette, the *Coquille*, during the years 1822 to 1825, that Lesson observed the galatheid crab, *Grimotea gregaria*, so-called, in such abundance that it gave the water the appearance of blood, a phenomenon already observed by Banks on his voyage with Captain Cook. As the result of Doctor Coker's labors, we are able to-day to differentiate this species from the true *Munida gregaria*. (See *M. cokeri*, on p. 559.)

The most important contribution to our knowledge of the fauna was made by d'Orbigny on his voyage to South America during 1826 to 1838. The Crustacea were described by Milne Edwards and Lucas and illustrated largely with colored drawings. Their report forms the basis of all subsequent work on the crustacean fauna of Peru and Chile.

The United States exploring expedition around the world during 1838 to 1842, under the command of Capt. Charles Wilkes, U. S. N., touched at Callao, and a number of species from that point are included in the report by James D. Dana on the Crustacea in the collection.

Other expeditions that have added to our knowledge of Peruvian Crustacea are those by the Austrian frigate *Novara* during 1857 to 1859, the British ship *Challenger* during the years 1873 to 1876, and the Italian *Vettor Pisani* during 1882 to 1885. The Crustacea of this last voyage were reported on by Cano in 1889; the lists of species from Peru are much fuller than those given by Kinahan, but their value is impaired by the obvious error in localities assigned to many strictly oriental species. These will be found in my list of species incorrectly referred to Peru.

For the study of the Crustacea of the west coast of South America, the third volume of Gay's *Historia de Chile* is indispensable; each species known up to 1849 is there described by Nicolet, and many are figured in the second volume of the folio atlas.

Recent additions to the fauna.—The crustacea obtained by Doctor Coker were collected at various points on the coast between latitudes 3° 30' and 17° S.; on the beaches and salt marshes, in shallow water along shore, in fish nets, and with the dredge and trawl in a few fathoms at three or four stations; also in the rivers and at the markets. More extensive dredging in shoal waters would no doubt result in a much greater number of forms. The new stalk-eyed species and subspecies number 7; of the known species, there are 27 additions to the Peruvian fauna, making in all 122 species.

The most notable additions are a *Dromidia*, the first typical dromiid reported on the west coast of South America; and specimens of *Panopeus bermudensis* hitherto known only from the Atlantic. *Eupleurodon trifurcatus* and *Hepatella amica* have never before been noted since their first description. One is impressed by the superabundance of Xanthidæ and Inachidæ and the scarcity of Parthenopidæ and of shrimps of all kinds.

The number of interrogation points in the list of synonyms gives an indication of the amount of work still to be done before the fauna of the west coast of South America is thoroughly known. Fortunately, the governments of both Peru and Chile have become aware of the importance of a knowledge of the marine fauna, and it is hoped that the work so well begun will be continued with the same vigor.

The Peruvian Province.—The Crustacea of Peru form part of a fauna corresponding to the molluscan "Peruvian Province," defined by Dall^a as extending from Guayaquil, Ecuador, to the island of Chiloë, in southern Chile. While the southern limit of the fauna is rather well defined, the transition at the north into the Panamic Province is much more gradual. For this reason there have been included in my list of species likely to occur in Peru all those recorded from Panama southward to Chiloë, down to a depth of 10 fathoms; also all fresh-water decapods on the Pacific slope south of Panama.

Some of the species listed from southern Chile, as *Lithodes antarctica* and perhaps *Paromola rathbuni* and *Palinustus frontalis*, belong properly to the Magellanic Province.

ANNOTATED LIST OF THE SPECIES COLLECTED BY R. E. COKER.

INACHOIDES MICRORHYNCHUS Milne Edwards and Lucas.

Plate 36, fig. 1.

Inachoides microrhynchus MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, pt. 1, 1843, p. 5; vol. 9, atlas, 1847, pl. 4, fig. 2.

Carapace subtriangular, longer than broad, setose, convex, uneven, the most elevated portions and the margins tuberculated; postorbital tooth triangular; supraorbital tooth blunt; rostrum spiniform, equal in length to distance between orbits. Antennæ visible beside ros-

^aProc. U. S. Nat. Mus., vol. 37, 1909, no. 1704, p. 185.

trum. Chelipeds in the male long and very stout, palms much swollen, longer than fingers, which gape narrowly in basal half; chelipeds in the female feeble, fingers as long as palm. Legs slender, subcylindrical.

Length 10 to 20 mm.

Dredged, Bay of Sechura, about half-way between Bayovar and Mataballa, in 5 to 6 fathoms, April 10, 1907.

Not previously known from Peru.

Distribution.—Peru; Chile.

EPIALTUS MARGINATUS Bell.

Plate 36, fig. 2.

Epialtus marginatus BELL, Proc. Zool. Soc. London, pt. 3, for 1835 (1836), p. 173; Trans. Zool. Soc. London, vol. 2, 1836, p. 62, pl. 11, fig. 4 (female); pl. 13 (male).

Large. Carapace very convex, suborbicular, save for the flat, deflexed rostrum, smooth; lateral border marginate, two teeth anteriorly, an obscure tooth at widest part of carapace and a trace of another behind it. Rostrum subtriangular, tip bifurcate; preorbital tooth present. Eye-stalks globular, sunk in the circular orbits. Chelipeds elongate, very strong in male, two tubercles on upper edge of arm, one tooth at antero-internal angle of wrist, fingers long, gaping. Legs diminishing rapidly in length from first to fourth, a setiferous tooth on under side of propodites increasing in the same order; dactyli bluntly spinulose beneath.

Length 8 to 10 cm.

Shells of crabs from Independencia Bay, July, 1907.

"Apancora," also called "Jaiva" by some. Taken in fish net near the shore, Molendo, July 22 and 23.

Distribution.—Galapagos Islands; Peru to Chile; Rio Janeiro (?).

ACANTHONYX PETIVERII Milne Edwards.

Plate 46, fig. 4.

Acanthonyx petiverii MILNE EDWARDS, Hist. Nat. Crust., vol. 1, 1834, p. 343.—DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 128; atlas, 1855, pl. 5, fig. 6. *Acanthonyx emarginatus* MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, pt. 1, 1843, p. 9; vol. 9, atlas, 1847, pl. 5, fig. 2.

Small. Carapace elongate, subpentagonal, nearly smooth, a few tufts of hair; lateral margins nearly parallel, tridentate, first tooth large, at antero-lateral angle; preorbital tooth present; rostrum short, deflexed, tip bifurcate; each marginal tooth is fringed with hair. Antennæ visible either side of beak. Orbits in sides of carapace; eyes visible from above. Chelipeds short, considerably enlarged in male; two tubercles on lower outer edge of arm; wrist cristate above; palm longer than fingers, which gape narrowly. Legs

compressed, decreasing in length from first to fourth; propodi dilated, a blunt tooth on under edge against which the dactylus plays.

Length 15 to 18 mm.

Dredged, Bay of Sechura, about half-way between Bayovar and Mataballa, in 5 to 6 fathoms, April 10, 1907.

Taken from seaweed, Chinchá, North Island, June 18, 1907.

Distribution.—From Cape St. Lucas, Lower California, to Chile; Galapagos Islands. Also east coast of tropical America.

EUPLEURODON TRIFURCATUS Stimpson.

Plate 49, fig. 5.

Eupleurodon trifurcatus STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 98.

Very small. Carapace pentagonal, post-rostral portion broader than long, a strong forward-projecting tooth at antero-lateral angle, and a large tooth farther back on side margin; surface uneven, armed with about fourteen setose tubercles. A strong preorbital tooth. Rostrum bifid, the teeth lobiform and inclined toward each other. Chelipeds small; two tubercles and a terminal tooth on upper edge of arm; wrist nodose; upper edge of palm concave. Propodi and dactyli of legs subequal in length, a strong tooth on proximal half of propodi.

Length 8 to 10 mm.

From rocks between tide lines, north end of Ferrol Bay (Chimbote), March 1.

Not previously known from Peru.

Distribution.—Cape St. Lucas, Lower California; Peru.

MICROPHRYS PLATYSOMA (Stimpson).

Plate 50, fig. 3.

Milnia platysoma STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 180.

Carapace subtriangular, posterior margin arcuate; surface tuberculate, with occasional long hairs; uneven, margins spinulose; two larger spines, one above the other, at outer angle of branchial region; three marginal laminae, one on orbital tooth, one on hepatic region, and the other on branchial region; between and below the last two a spine; orbit deeply fissured above; preorbital spine present; between it and the rostrum a prominent antennal spine; rostrum bispinous. Chelipeds strong in male, feeble in female; arm and wrist tuberculate, arm with flat teeth above; fingers in male widely gaping and dactylus with large basal tooth; fingers in female nearly meeting. Legs cylindrical, rapidly diminishing from first to fourth; subterminal spine on merus of first pair.

Length 12 to 18 mm.

From rocks between tide lines, north end of Ferrol Bay (Chimbote), March 1.

Distribution.—From Lower California to Peru; Galapagos Islands; Porto Rico.

MICROPHRYS ACULEATUS (Bell).

Plate 45, fig. 4.

Pisa aculeata BELL, Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 171; Trans. Zool. Soc. London, vol. 2, 1836, p. 50, pl. 9, fig. 7.

Carapace ovate, surface setose and hairy; a transverse series of spines across cardiac and branchial regions; two spines at outer angle of branchial region; three elongated laminae on lateral margin, without intermediate spine. Rostral and antennal spines more slender and cylindrical than in *M. platysoma*. Arm with three triangular teeth above; spine on carpal joints of legs.

Length 15 to 18 mm.

Lobos de Afuera, March 18, 1907. Rocky bottom, along shore, which is covered with a growth of seaweed.

Not previously known from Peru.

Distribution.—Galapagos Islands; Ecuador; Peru.

TELEOPHRYS CRISTULIPES Stimpson.

Plate 46, fig. 2.

Teleophrys cristulipes STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 190, pl. 2, fig. 2.

Mithrax (Teleophrys) cristulipes A. MILNE EDWARDS, Crust. Rég. Mex., 1875, p. 113, pl. 19, fig. 2.

Carapace ovate, a little broader than long, convex, granulate and tuberculate, three small spines on branchial margin, of which one is at the lateral angle and the others before and behind it. Orbital border not fissured; a preorbital tooth. Rostral horns short, thick, nearly contiguous, or curving toward each other. Chelipeds of male very large, inner border laminate; arm tuberculate, wrist carinate; fingers widely gaping, a tooth near middle of dactyl. Chelipeds of female similar but feeble, fingers narrowly gaping. Legs armed with laminiform spines except on the dactyli.

Width 10 to 15 mm.

Dredged, Bay of Sechura, about half-way between Bayovar and Mataballa, in 5 to 6 fathoms, April 10, 1907.

Distribution.—From Cape St. Lucas, Lower California, to Peru; Galapagos Islands; also Brazil.

CALLINECTES TOXOTES Ordway.

Plate 55.

Callinectes toxotes ORDWAY, Boston Journ. Nat. Hist., vol. 7, 1863, p. 576.—RATHBUN, Proc. U. S. Nat. Mus., vol. 18, 1896, p. 363, pls. 21; 24, fig. 9; 25, fig. 9; 26, fig. 9; 27, fig. 8.

Very large. Carapace twice as wide as long, hexagonal, with a strong spine on each side and a row of eight teeth between the spine

and the orbit; surface uneven, granulate, two transverse granulated ridges. Front and orbits together equaling one-third width of carapace; front between orbits four-toothed, teeth broadly rounded; orbits and eyes large. Chelipeds long and strong; arm with four large spines on inner edge and a terminal spine on outer edge; palm prismatic, with seven granulate ridges and a spine at either end; fingers as long as palm; prehensile edges armed with stout irregular teeth. Legs flattened, last pair very broad, especially the last two segments, which form a swimming paddle. Abdomen of male broad at base, narrow distally; third to fifth segments fused; terminal segment in both sexes longer than one-half of penult segment; appendages of first segment in male sinuous, reaching nearly to end of abdomen.

Width 18 to 19 cm.

Taken with casting net, mouth of river Tumbes, January 15, 1908. "Jaiva." Said to be very abundant at times. Only a few were seen during my stay in the region (January 15 to February 15). Of economic value.

Not previously reported from Peru.

Distribution.—From Cape St. Lucas, Lower California, to Peru.

CALLINECTES ARCUATUS Ordway.

Plate 56.

Callinectes arcuatus ORDWAY, Boston Journ. Nat. Hist., vol. 7, 1863, p. 578.—RATHBUN, Proc. U. S. Nat. Mus., vol. 18, 1896, p. 362, pls. 20; 23, fig. 1; 24, fig. 8; 25, fig. 7; 26, fig. 7; 27, fig. 7.

Similar to the preceding, but smaller; intramedial area shorter and broader; antero-lateral region smoother; frontal teeth more triangular, acute, the middle pair very small. Terminal segment of abdomen in both sexes shorter than one-half of penult segment; appendages of first segment in male straight or nearly so, not reaching terminal segment of abdomen.

Width 10 to 12 cm.

Oyster beds of Matapalo, near Capon, February 3 ("Jaivas").

On the beach at Las Vacas, near Capon, January 23, 1908 ("Jaiva").

Not previously known from Peru.

Distribution.—From Lower California to Peru.^a

ARENÆUS MEXICANUS (Gerstaecker).

Plate 37, fig. 2.

Euctenota mexicana GERSTÆCKER, Arch. für Naturg., vol. 22, pt. 1, 1856, p. 131, pl. 5, figs. 3 and 4.

Neptunus mexicanus A. MILNE EDWARDS, Crust. Rég. Mex., 1879, p. 212, pl. 42, fig. 3.

Of medium size. Carapace twice as broad as long, hexagonal, with the antero-lateral margins more arcuate than in *Callinectes* and

^a Professor Porter records a fragment of a *Callinectes* from Coquimbo, Chile.

cut into eight well-separated teeth; a strong spine at each lateral angle. Carapace covered with small whitish spots; very convex, densely granulate, a little uneven, ridges faint. Lower surface of carapace densely hairy, hair showing in dorsal view between the side teeth. Front between the orbits quadridentate, teeth separated by U-shaped sinuses; orbit with two open V-shaped sinuses above. Buccal cavity without a longitudinal ridge. Chelipeds and legs similar to those of *Callinectes*; arm spines feebler, none on outer edge; a spine at inner angle of wrist. Abdomen of male more triangular, less T-shaped than in *Callinectes*.

Width 75 to 85 mm.

Sand beach, Ancon, February 13.

Not previously known from Peru.

Distribution.—From west coast of Mexico to Peru.

PORTUNUS (PORTUNUS) ACUMINATUS (Stimpson).

Plate 49, fig. 4.

Achelous acuminatus STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 112.

A small, pubescent species. Carapace twice as broad as long, sub-hexagonal; antero-lateral margin armed with eight small curved teeth, of which the second, fourth, and sixth are a little smaller; a slender lateral spine; posterior margin truncate, angles rounded; surface uneven, granulate on the elevated portions, ridges strong. Of the four teeth of the front, those of the middle pair are more advanced; intervals V-shaped. Chelipeds elongate, prismatic; arm with four or five spines on inner margin, a terminal outer spine; wrist with two distal spines, one outer, the other inner and much longer; the seven ridges of the palm strong, granulate; a proximal spine and on upper margin a subdistal spine; fingers strongly ridged, tips dark colored and crossing. Legs much as in the preceding; the swimming feet have a spine at the distal end of the lower margin of the merus. Abdomen of male triangular.

Width about 30 mm.

Taken in trawl, Bay of Sechura, west of Mataballa, depth about 5 fathoms, April 8, 1907.

Dredged, Bay of Sechura, about half-way between Bayovar and Mataballa, in 5 to 6 fathoms, April 10, 1907.

Distribution.—From Panama to Peru.

CANCER POLYODON Pæppig.

Plate 38, fig. 2.

Cancer dentatus BELL, Proc. Zool. Soc. London, vol. 3, 1835, p. 87; Trans. Zool. Soc. London, vol. 1, 1835, p. 339, pls. 45, 47, figs. 4 and 5. Not *C. dentatus* HERBST, 1785.

Cancer polyodon PÆPPIG, Arch. für Naturg., vol. 2, pt. 1, 1836, p. 133.

Large and hairy. Carapace broadly oval, very convex, closely granulate; antero-lateral margin very long, armed with ten broad,

acute, and strongly projecting teeth, the first of which forms the outer angle of the orbit, and the last is the smallest; postero-lateral margin concave, bearing one small tooth. Front very narrow, tridentate, middle tooth more advanced and lower than the others. Orbits bordered by six prominent teeth. Maxillipeds exceeding the buccal cavity. Chelipeds nearly equal; wrists and upper borders of chelæ spinous; outer surface of palm crossed by five longitudinal, granulated ridges; fingers narrowly gaping, black color extending from tips half-way along outer border and whole length of inner border. Legs broad, flat.

Width 9 to 14 cm.

Sand beach, Ancon, February 13.

Callao, May 18, 1908.

Taken in fish net, rocky shore, northeast side of San Lorenzo Island, January 11, 1907.

Independencia Bay, taken in 1 fathom at the "Punta Callao" of Isla Vieja, July 20, 1907. "Cangrejos" of economic value.

Distribution.—Ecuador; Peru; Chile.

CANCER PLEBEJUS Pœppig.

Plate 38, fig. 1.

Cancer irroratus BELL, Proc. Zool. Soc. London, vol. 3, 1835, p. 87; Trans. Zool.

Soc. London, vol. 1, 1835, p. 340, pl. 46 (part). Not *C. irroratus* SAY.

Cancer plebejus PœPPIG, Arch. für Naturg., vol. 2, pt. 1, 1836, p. 134.

Large and sparsely hairy. Carapace a little shorter and broader than the preceding; also smoother. The ten teeth of the antero-lateral margin are broad, low, and separated largely by closed fissures; the postero-lateral tooth is indicated by a simple notch. Teeth of front and orbits less strong than in *C. polyodon*; no tooth on upper margin of orbit between inner and outer teeth. Maxillipeds less produced than in *C. polyodon*, their distal margins more transverse. Chelipeds subequal; two spinous crests on upper surface of chelæ; four additional granulated ridges on outer face of palm; dark color restricted to a small area near extremity of fingers and along the prehensile teeth; gape very slight. Legs broad, flat, nearly naked.

Width 10 to 12 cm.

Callao, May 18, 1908.

Distribution.—From Peru to Port Otway, Patagonia.

PLATYXANTHUS ORBIGNYI (Milne Edwards and Lucas).

Plate 40, fig. 2.

Xantho orbignyi MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 14; vol. 9, atlas, 1847, pl. 7, fig. 1.

Very large. Carapace broad, slightly convex and uneven; antero-lateral margins strongly arched, continuous with margin of front and

cut into from eight to ten strong saw-teeth, some of which may have an accessory tooth; last tooth with a dorsal ridge continued on the carapace. Front four-toothed, teeth blunt, middle pair more advanced, middle sinus deepest. Lower margin of orbit prominent, bidentate, upper margin with two closed fissures. Chelipeds strong, smooth, unequal; a low protuberance on upper border of arm and an acute tooth at inner angle of wrist; palms swollen, fingers shorter than palm, gaping, dark-colored except at outer base, teeth and tips white. Legs flattened, tips horny. Under part of carapace, upper border of arm and margins of legs hairy. Color red.

Width 9 to 11 cm.

Callao, May 18, 1908.

Distribution.—Ecuador; Peru; Chile.

PLATYXANTHUS CRENULATUS A. Milne Edwards.

Plate 39, fig. 2.

Platyxanthus crenulatus A. MILNE EDWARDS, Bull. Soc. Philom. (7), vol. 3, 1879, p. 106, pl. 2, fig. 1.

Large. Carapace transverse, subhexagonal, very convex, uneven. Antero-lateral margins angled, cut into four teeth, exclusive of orbital angle; three teeth are broad and subtruncate, posterior tooth subacute, thickened. Of the four frontal teeth, the two outermost are broad, obliquely truncate. Inner suborbital tooth flattened, broadly rounded. Chelipeds very strong and unequal; a stout tooth above arm, another at inner angle of wrist; chelæ more compressed than in *P. orbigny*; fingers as long as palm, dark color extending the length of prehensile border (the teeth themselves are white), but less than half way up the outer edges. Legs much narrower than in the preceding; dactyli prismatic, hairy.

Width 8 to 9 cm.

Taken in boat beam trawl dredging in 7 to 8 fathoms, southeast of Caleta Colon, Bay of Payta. Soft mud bottom. April 13.

Thrown on the beach near the mouth of the Rimac by a strong sea, February 4, 1907. From the beach at Pisco, July 7, 1908.

Distribution.—From Peru to Patagonia.

XANTHO GAUDICHAUDII Milne Edwards.

Plate 39, fig. 1.

Xantho gaudichaudii MILNE EDWARDS, Hist. Nat. Crust., vol. 1, 1834, p. 396.—MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, pt. 1, 1843, p. 15; vol. 9, atlas, 1847, pl. 5, fig. 4.

Of medium size. Carapace octagonal, thick, deeply areolated; antero-lateral margin with three teeth remote from orbit; postero-lateral margin straight; front, between orbits, one-fourth as wide as

carapace, subtruncate, bilobed, lobes concave; orbital margin with three closed fissures and no teeth. Chelipeds unequal, stout, rugose; arm short, denticulate above; wrist with two blunt teeth at inner angle, one below the other; palm swollen; fingers dark-colored, gaping, teeth low. Legs short, thick; dactyli stout, furry, with short, horny tips.

Width 20 to 45 mm.

Taken in trawl, Bay of Sechura, west of Mataballa, depth about 5 fathoms, April 8, 1907.

Tide pool on shingle beach at La Punta, December, 1906.

Distribution.—From Ecuador to Patagonia; Juan Fernandez.

CYCLOXANTHOPS SEXDECIMIDENTATUS (Milne Edwards and Lucas).

Plate 40, fig. 1.

Xantho sexdecimidentatus MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 15; vol. 9, atlas, 1847, pl. 7, fig. 2.

Of medium size. Carapace transversely suboval, the antero-lateral margins being very long and arched, the postero-lateral margins short and nearly straight; front narrow, bilobed, lobes oblique, truncate, separated by a closed fissure. Antero-lateral teeth eight on each side, irregular in size and shape. Preorbital tooth, above and below, well marked; three orbital fissures closed. Chelipeds stout, very unequal; arm short and broad; wrist with two teeth at inner angle and a short subdistal spine above; palm broad, compressed; fingers dark, nearly closing.

Width 40 to 45 mm.

Taken in trawl, Bay of Sechura, west of Mataballa, depth about 5 fathoms, April 8, 1907.

Dredged, Bay of Sechura, about half-way between Bayovar and Mataballa, in 5 to 6 fathoms, April 10, 1907.

Lobos de Afuera, March 25.

Tide pool on shingle beach at La Punta, December, 1906.

Dredged near northeast side of San Lorenzo Island, depth 2½ fathoms, February 5.

Dredged in Bay of Chilca, September 2, 1907.

Independencia Bay, taken in 1 fathom at the "Punta Callao" of Isla Vieja, July 20, 1907. "Cangrejos" of economic value.

Distribution.—Ecuador to Chile.

PANOPEUS PURPUREUS Lockington,

Plate 41, fig. 2.

Panopeus purpureus LOCKINGTON, Proc. Cal. Acad. Sci., vol. 7, 1876 (1877), p. 101.—A. MILNE EDWARDS, Crust. Rég. Mex., 1880, p. 316, pl. 57, fig. 3.

Carapace convex in both directions; regions well marked; surface granulate and with several short transverse ridges; shape hexagonal; antero-lateral margin shorter than postero-lateral, armed with five teeth (orbital included), the first two small and partly fused, the

others large and acute. Front divided by a median fissure, a small tooth at outer angle; orbits large, three large sinuses below. Chelipeds unequal, strong; two teeth on upper border of arm and one at inner angle of wrist; fingers dark, the color of the immovable finger not reaching quite to its base; fingers deflexed, not gaping, a strong tooth at base of larger dactyl. Legs long, narrow, hairy.

Width 37 to 50 mm.

Taken in casting net at mouth of River Tumbes (Boca Alamo), January 15, 1908.

Not previously known from Peru.

Distribution.—From Lower California to Peru.

PANOPEUS CHILENSIS Milne Edwards and Lucas.

Plate 41, fig. 4.

Panopeus chilensis MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 16; vol. 9, atlas, 1847, pl. 8, fig. 2.

Similar to the preceding; regions more deeply marked; surface rougher, with more numerous transverse ridges; first two antero-lateral teeth more widely separated; last three teeth narrower and more falcate; front narrower, its lobes more pronounced; distal tooth of arm stronger; legs broader, especially the propodi of the last two pairs.

Width 38 to 48 mm.

Oyster beds of Matapalo (near Capon), January 23, 1908.

Distribution.—West coast of Mexico to Chile.

PANOPEUS BERMUDENSIS Benedict and Rathbun.

Panopeus bermudensis BENEDICT and RATHBUN, Proc. U. S. Nat. Mus., vol. 14, 1891, p. 376, pl. 20, fig. 2; pl. 24, figs. 14 and 15.

Small. More oval than the preceding species; antero-lateral more nearly equal to postero-lateral margin; surface strongly areolate, transverse rugæ numerous; of the five lateral teeth, the first and second are separated by a very shallow sinus, the second much less advanced than the first; last three sinuses deep; third and fourth teeth subacute; fifth tooth narrow, acute. Border of front medially emarginate, each lobe faintly sinuous; upper edge of orbit between sutures separately convex. Chelipeds unequal, granulate, granules reticulating; a superior tooth on arm, an inner tooth on wrist; a groove at distal end of wrist and on upper surface of palm; larger chela high,



FIG. 1.—*PANOPEUS BERMUDENSIS*,
MALE X 14.

fingers dark with light tips, gaping in male, a large tooth at base of dactyl. Legs narrow, hairy, dactyli elongate, with slender horny tips.

Width 6 to 14 mm.

Oyster beds of Matapalo (near Capon), January 23, 1908, one male; two females were taken from masses of sponge at the same place.

Not before recorded from the west coast of America.

Distribution.—Peru. From Florida to Brazil; Bermudas.

EURYPANOPEUS TRANSVERSUS (Stimpson).

Panopeus transversus STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 210.—BENEDICT and RATHBUN, Proc. U. S. Nat. Mus., vol. 14, 1891, p. 367, pl. 22, fig. 2; pl. 24, fig. 9.

Small. Carapace broadly oval, posterior half flat, anterior half inclined downward to the margin; regions indicated. Of the five normal teeth of the lateral margin, the first two are completely fused and form a truncate lobe; next two teeth also lobiform; last tooth dentiform, blunt; last three sinuses V-shaped. Front faintly four-lobed. Chelipeds unequal; a stumpy tooth at inner angle of wrist; fingers rather slender, those of the larger chela of male narrowly gaping, the dactylus with a slightly enlarged tooth at its base. Legs narrow, compressed.

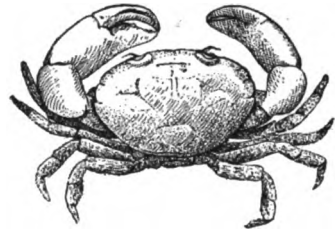


FIG. 2.—EURYPANOPEUS TRANSVERSUS, MALE, NATURAL SIZE.

Width 18 to 20 mm.

On the beach at Las Vacas, near Capon, January 23, 1908. Called "Pangoritas;" in the belief of the fishermen, these are the females corresponding to *Eriphia squamata*, male!

Not previously known from Peru.

Distribution.—From Salvador, Central America, to Peru.

EURYTIUM TRISTANI Rathbun.

Plate 47, fig. 1.

Eurytium tristani RATHBUN, Proc. Biol. Soc. Wash., vol. 19, 1906, p. 100.

Carapace very convex from front to back, transverse, hexagonal; surface very finely granulate, without ridges, regions fairly marked; antero-lateral margin very short, cut into five teeth, including tooth at outer angle of orbit, the first two teeth partly fused, the others strong, the fifth most acute; postero-lateral margins very long and convex. Front about one-fourth as wide as carapace, with two rounded lobes; orbits of good size, with three large sinuses below. Chelipeds very unequal, heavy; arm with tubercles and a strong tooth above; wrist with a strong inner tooth; fingers light colored,

gaping, larger dactyl with a large molariform tooth at its base. Legs compressed, margins hairy, dactyli long, slightly curved.

Width 28 to 52 mm.

Salto (near Capon), January 31.

Not previously known from Peru.

Distribution.—Costa Rica; Peru.

PILUMNOIDES PERLATUS (Pæppig).

Plate 50, fig. 2.

Hepatus perlatus PÆPPIG, Arch. für Naturg., vol. 2, pt. 1, 1836, p. 135, pl. 4, fig. 2.

Pilumnoides perlatus MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, pt. 1, 1843, p. 21; vol. 9, atlas, 1847, pl. 9, fig. 1.

Small. Carapace convex, suborbicular, broader than long; anterior two-thirds tuberculate, posterior third nearly smooth; antero-lateral margin with five or six irregular teeth, the margin continued inward upon the carapace by a granulous line. Front most produced at middle, bilobed; orbit subcircular, margin almost entire. Chelipeds equal, stout, tuberculate, the tubercles arranged in rows on lower half of palm, one row terminating in a large tooth on outside of immovable finger; upper edge of palm tridentate; fingers brown with white tips, gaping slightly in basal half. Legs slender, terminal half furry; dactyli ending in long, curved, horny tips.

Width 9 to 20 mm.

Taken in trawl, Bay of Sechura, west of Mataballa, depth about 5 fathoms, April 8, 1907.

Dredged near northeast side of San Lorenzo Island, depth 2½ fathoms, February 5.

Distribution.—From Panama to Chile.

ERIPHIA SQUAMATA Stimpson.

Plate 41, fig. 1.

Eriphia squamata STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 56.—

A. MILNE EDWARDS, Crust. Rég. Mex., 1880, p. 339, pl. 56, fig. 3.

Carapace truncate in front, sides convex anteriorly, straight and convergent posteriorly, greatest width considerably in front of middle. Surface anteriorly rough with granules and short rugæ; sides armed with seven or eight stout, curved spines. Interorbital distance one-half width of carapace; half this space lies between orbit and antennæ; front between antennæ cut by a broad median sinus into two truncate, tuberculate lobes; orbit nearly round. Chelipeds unequal, stout; wrist and hand covered with large, flattened, scale-like tubercles which become obsolete on lower part of palm; fingers stout, a large basal tooth on the dactyl. Legs compressed, long-hairy.

Width 35 to 40 mm.

Taken on the beach at Las Vacas, near Capon, January 23, 1908. "Pangora."

Distribution.—From Cape St. Lucas, Lower California, to Chile.

SPEOCARCINUS OSTREARICOLA, new species.

Plate 48, fig. 2.

Of small size. Body and legs coarsely hairy. Carapace subcylindrical, transverse, granulate, antero-lateral margin arcuate, tridentate. Front equal to one-fourth width of carapace. Eye-stalks distally slender, filling orbits. Chelipeds unequal, broad, nearly smooth; a tooth on upper edge of arm and inner edge of wrist; palm high, fingers narrowly gaping, toothed. Legs narrow, third pair longest; dactyli nearly straight, prismatic.

Width of type male 17.6 mm., length 12 mm.

In *S. granulimanus* Rathbun ^a of Lower California, which is nearly related to the above species, the carapace is narrower, side teeth smaller, hands and wrists coarsely granulate.

Type-locality.—Oyster beds of Matapalo (near Capon), January 23, 1908.

Type.—Cat. No. 40469, U.S.N.M. One male.

OSTRACOTHERES POLITUS Smith.

Plate 43, fig. 3.

Ostracotheres politus SMITH, Trans. Conn. Acad. Sci., vol. 2, 1870, p. 169.—LENZ, Zool. Jahrb., Suppl. vol. 5, 1902, p. 765, pl. 23, figs. 9 and 9a.

Small. Carapace thin, flattened, smooth and shining; transversely oval; front not projecting; a median sulcus on front and a U-shaped sulcus extending from orbits to middle of carapace. Palp of outer maxilliped two-jointed. Chelipeds equal; segments rounded, smooth; hands compressed; fingers not gaping; dactylus with basal tooth. Legs short, cylindrical; dactyli of first three pairs short and curved, dactyli of first and second pairs folding against the expanded distal end of propodus which is clothed with hair; fourth pair of legs much the slenderest, dactylus slightly curved and as long as the propodus.

Width 7 to 14 mm.

Found with *Crepidula*-like form [*C. dilatata*] on mussels taken in Ancon Bay.

Distribution.—Peru; Chile. Living within shells of mollusks.

DISSODACTYLUS NITIDUS Smith.

Plate 48, fig. 6.

Dissodactylus nitidus SMITH, Trans. Conn. Acad. Sci., vol. 2, 1870, p. 173.

Of small size. Carapace transversely oblong, flattened, smooth. Front narrow; eyes minute. Buccal cavity broad behind, arched anteriorly, very nearly reaching the front. Palate not divided by a median ridge. Ischium and merus of outer maxillipeds coalesced, palpus of two segments, the terminal one large and spatulate. Cheli-

^a Proc. U. S. Nat. Mus., vol. 16, 1893, p. 242.

pedes small, equal; hands short, rounded. Legs small, slender; dactyli of first three pairs short and deeply bifurcate, of last pair simple and slender. Sternum of male broad and flat; abdomen narrow, three-jointed, first and second normal joints being fused, and third to sixth inclusive also fused.

Width 5 to 6.5 mm.

Taken in trawl, Bay of Sechura, west of Mataballa, depth about 5 fathoms, April 8, 1907.

Not previously known from Peru.

Distribution.—Lower California (off Abreojos Point) to Peru.

PINNIKA TRANSVERSALIS (Milne Edwards and Lucas).

Plate 46, fig. 1.

Pinnotheres transversalis MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 23; vol. 9, atlas, 1847, pl. 10, fig. 3.

Carapace high, more than twice as wide as long, oblong, the outer ends inclined downward; a transverse ridge on the posterior part of the carapace. Front narrow, truncate, deflexed; orbits small, oval. Palpus of outer maxilliped very large, with three segments, the last of which is articulated to the inner side of the preceding; both of these are fringed with long hair. Chelipeds equal, with hairy margins; chelæ compressed, tapering distally, sparsely granulous, two granulous and hairy ridges on outer surface and one on lower margin. A line of hair between second and third abdominal segments.

Width 17 to 22 mm.

Dredged near northeast side of San Lorenzo Island, depth 2½ fathoms, February 5. Taken from a piece of tube resembling the end of a tube of *Chætopterus*.

Distribution.—From Panama to Punta Arenas, Patagonia.

PINNOTHERELIA LÆVIGATA Milne Edwards and Lucas.

Plate 51, fig. 3.

Pinnotherelia lævigata MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 25; vol. 9, atlas, 1847, pl. 9, fig. 1.

Small. Carapace smooth, firm, a little broader than long, subrectangular, with the corners rounded off, flat except in its anterior portion, which is strongly bent down. Front two-fifths as wide as carapace; orbits and eyes oval. Outer maxillipeds parallel to each other; ischium distinct from and smaller than merus; palpus very large, segments end to end. Sternum flat, forming an angle with the plane of the carapace. Chelipeds stout, smooth; palms inflated; fingers narrowly gaping. Legs flattened, second longest; meropodites and propodites thickly hairy beneath.

Width 10 to 12 mm.

Callao. These casts were found on the rocks of the inner side of the natural dyke of rubble separating the lagoon at the mouth of the river from the ocean.

Distribution.—Peru; Chile.

GRAPSUS GRAPSUS (Linnaeus).

Plate 42, fig. 1.

Pagurus maculatus CATESBY, Nat. Hist. Carolina, Florida, and the Bahama Islands, vol. 2, 1743, p. 36, pl. 36, fig. 1.

Cancer grapsus LINNÆUS, Syst. Nat., 10th ed., vol. 1, 1758, p. 630.

Of good size. Carapace discoidal, crossed by obliquely transverse ridges, tuberculate anteriorly; one side tooth behind the dentiform antero-lateral angle. Front broad, high, almost vertical, overhanging epistome and almost concealing antennules; four prominent superior tubercles. Chelipeds short, stout, tuberculate and striate; a broad flat tooth on wrist; tips of fingers broad, spoon-shaped. Legs long, broad and flat; dactyli short, spinous.

Width 70 to 85 mm.

Pescadores Islands, February 12. Abundant, running on the rocky shores, in and above the surf.

From the rocks in and above the surf, north end of Callao water front, December 27, 1906. The crabs of this or closely related species are exceedingly abundant on all rocky shores from Independencia Bay to Lobos de Tierra, at least.

"Araña." Crab abundant on the rocky shores, usually just above the water. Valued for bait in the line fishing. Chincha Islands, July 13.

"Araña." Mollendo, July 25, 1908.

Distribution.—From Lower California to Chile; Galapagos Islands; Juan Fernandez. Also shores of tropical Atlantic.

LEPTOGRAPSUS VARIEGATUS (Fabricius).

Plate 45, fig. 2.

Cancer variegatus FABRICIUS, Ent. Syst., vol. 2, 1793, p. 450.

Grapsus planifrons DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 338; atlas, 1855, pl. 21, figs. 3a-3e.

In size and shape similar to preceding. Two side teeth behind antero-lateral angle. Front broad, moderately inclined, truncate. Chelipeds larger than in *Grapsus*; inner margin of arm laminate; tooth of wrist small; outer surface of palm nearly smooth; fingers widely gaping at base in male. Legs of moderate length; last two joints spinous. Form and color variable.

Width 60 to 70 mm.

"Cangrejo." Mollendo, July 25, 1908.

Distribution.—From Peru to Chile; Juan Fernandez; also Australia and other parts of the southern hemisphere.

GONIOPSIS PULCHRA (Lockington).

Plate 47, fig. 3.

Goniograpsus pulcher LOCKINGTON, Proc. Cal. Acad. Sci., vol. 7, 1876 (1877), p. 152 [8].

Carapace subquadrilateral, convex, smooth in the middle, striated elsewhere. Front half as wide as carapace, vertical, four lobes above.

Chelipeds short, stout; inner margin of arm laminate and spinous; wrist spinulose; chelæ flat; tips of fingers narrow, slightly spoon-shaped. Legs spinous and hairy; merus joints broad. Color dark, purplish or brown, mottled with citrine on the carapace, yellowish on the legs.

Width 30 to 40 mm.

Taken on the beach at Las Vacas, near Capon, January 23, 1908. "Chanduya," common on muddy beaches; noted especially about the mangrove swamps.

Not previously known from Peru.

Distribution.—From Magdalena Bay, Lower California, to Peru.

PACHYGRAPSUS TRANSVERSUS (Gibbes).

Plate 46, fig. 3.

Grapsus transversus GIBBES, Proc. Amer. Ass. Adv. Sci., vol. 3, 1850, p. 181.

Goniograpsus innotatus DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 345; atlas, 1855, pl. 21, fig. 9 a-c.

A small species. Carapace trapezoidal, much broader than long and much broader in front than behind; transversely and obliquely striated; one tooth behind the outer tooth of the orbit. Front inclined, more than half as wide as carapace, edge sinuous. Chelipeds equal, stout, striated; inner lamina of arm distally lacinate; a blunt tooth on wrist; propodus with an obliquely longitudinal line near lower edge; palm nearly smooth outside. Legs spinous at extremity of upper and lower margins of merus; margins sparsely clothed with long bristles; dactyli with long spines.

Width 12 to 15 mm.

On the beach at Las Vacas, near Capon, January 23, 1908.

Oyster beds of Matapalo, near Capon, January 23, 1908.

Distribution.—From California to Peru; Galapagos Islands. Also widely distributed in tropical Atlantic and Oriental Region.

ARATUS PISONI (Milne Edwards).

Plate 50, fig. 4.

Sesarma pisonii MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 76, pl. 19, figs. 4 and 5.

Carapace trapezoidal, nearly as long as wide, very narrow behind; regional furrows deep, sides striated. Front vertical, very wide, showing four lobes above and reaching nearly to the buccal cavity. Chelipeds of moderate length, stout in male; arm inwardly expanded; outer surface of wrist obliquely elongate; claws tuberculate, an oval area on the outside is covered with long black bristles; fingers narrowly gaping. Legs thin, flat, last two joints hairy on margins; two spines at end of upper edge of merus joints; propodus very long; dactyli very short.

Width 20 to 25 mm.

Near Capon, February 2. "Cangrejos de los manglares." Commonly seen climbing on the roots and branches of the mangroves, sometimes entering holes in its mud (which may, however, pertain to other species of crabs).

Not previously known from Peru.

Distribution.—From Nicaragua to Peru; also on the east coast of America.

CARDISOMA CRASSUM Smith.

Plate 44.

Cardiosoma crassum SMITH, Trans. Conn. Acad. Sci., vol. 2, 1870, p. 144, pl. 5, fig. 5.

Of huge size. Carapace thick, convex, subcordate, deeply furrowed, otherwise smooth. Front truncate, about one-fourth as wide as carapace. Eyes stout, moderately long, in large triangular orbits. Merus of outer maxillipeds notched at summit. Chelipeds massive, very unequal, mostly smooth, margins tuberculate or bluntly spinous, larger claw longer than width of body, its fingers gaping, armed with strong prehensile teeth. Terminal joint of legs spinous.

Width about 125 mm., length of large claw about 150 mm.

Mouth of River Tumbes, February 12. The "Cangrejo sin boca" (mouthless crab), an inappropriate and inexplicable name.

Not previously known from Peru.

Distribution.—From La Paz, Lower California, to Peru.

UCIDES OCCIDENTALIS (Ortmann).

Plate 42, fig. 2.

Uca una MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 23.

Uca laevis MILNE EDWARDS, Arch. Mus. Hist. Nat., Paris, vol. 7, 1854, p. 185, pl. 16, figs. 1 and 1a.

Edipleura occidentalis ORTMANN, Zool. Jahrb. Syst., vol. 10, 1897, p. 336.

Of large size. Sexes very unlike. Carapace thick, very convex, in male transversely oval, in female much narrower and with a well-defined marginal line. Front narrow, arcuate, bent down. Eyes of moderate length, nearly filling orbits. Merus of outer maxillipeds quadrate, not notched at summit. Chelipeds of male very long, nearly equal, very spinous on the margins and inner surface. Palms longer than the broad, flat, narrowly gaping fingers; chelipeds of female much shorter, relatively broader, very unequal, similarly roughened, palm not noticeably longer than fingers, which gape widely in larger claw. Legs margined with fringes of hair, especially beneath; terminal joint unarmed.

Width of male about 95 mm., of female about 75 mm.; length of longer cheliped of male about 23 cm.

From the mangrove swamps at Las Vacas in the region of Capon, January 23, 1908. This is the "cangrejo" abundant in the mud of the mangrove swamps of the region.

They are taken at low tide by thrusting one's arm into the deep holes in the mud. The fisherman first enlarges the hole with his foot. The meat is of excellent flavor. Color: Carapace olive-green, margined with orange; claws, legs, and eye stalks deep red. A handsome and valuable form.

Not previously known from Peru.

Distribution.—From Lower California to Peru; Valparaiso (?).

OCYPODE GAUDICHAUDII Milne Edwards and Lucas.

Plate 43, fig. 2.

Ocypoda gaudichaudii MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 26; vol. 9, atlas, 1847, pl. 11, figs. 4-4b.

Carapace squarish, broader than long, anterior corners flattened. Front between the eyes narrow, bent down. Eyes large, elongated, prolonged beyond the cornea in a slender style. Chelipeds stout, unequal, rough, fingers with truncate ends. Legs long, finely roughened.

Width about 40 mm.

Taken on the beach at Las Vacas, near Capon, January 23, 1908. "Carretero" (=cart-driver).

Beach, Lobos de Tierra, March 30.

Sand beach, Chimbote, February 27. Very abundant.

Sand beach, Ancon, February 13. Their burrows were common on the beach, but only two crabs were seen out on the beach (early afternoon).

Distribution.—From Lower California to Chile; Galapagos Islands.

UCA PRINCEPS (Smith).

Plate 48, fig. 3.

Gelasimus princeps SMITH, Trans. Conn. Acad. Sci., vol. 2, 1870, p. 120, pl. 2, fig. 10; pl. 3, figs. 3-3c.

Carapace trapezoidal, very broad, especially anteriorly, angles acute; surface nearly smooth. Front between the eyes very narrow, spatulate, bent down. Eyes with very long, slender stalks, set in deep orbits. One cheliped of male enormously developed, the hand joint longer than width of body; palm coarsely roughened; fingers long and broad, smooth except on margins; other cheliped of male and both chelipeds of female very small. Legs smooth, merus joints expanded.

Width of back 35 to 40 mm.

Salt flats at Puerto Grande on the Rio Zarumilla (2 leagues from Capon), February 2, 1908. "Maestro-Sastre" (meaning master-tailor).

Salt marshes back of Chuliyache (on Bay of Sechura).

Not previously known from Peru.

Distribution.—From San Bartolome Bay, Lower California, to Peru.

UCA INSIGNIS (Milne Edwards).

Plate 43, fig. 1.

Acanthoplax insignis MILNE EDWARDS, Ann. Sci. Nat. (3), Zool., vol. 18, 1852, p. 151, pl. 4, fig. 23; Arch. Mus. Hist. Nat., Paris, vol. 7, 1854, p. 162, pl. 11, figs. 1-1b.

Larger than *U. princeps*; carapace narrower, more uneven; side margins with a few small blunt spines or tubercles. Front and eyes similar to those of *U. princeps*. Large cheliped enormous; palm tuberculated, fingers very broad and flat, the movable finger having its widest point in the distal half. Merus joints of legs with blunt spines beneath.

Width of carapace about 45 mm., length of claw about 90 mm.

Salt marshes back of Chuliyache (on Bay of Sechura).

Distribution.—From Gulf of Fonseca, Salvador, to Chile.

UCA GALAPAGENSIS Rathbun.

Plate 46, fig. 6.

Uca galapagensis RATHBUN, Proc. Wash. Acad. Sci., vol. 4, 1902, p. 275, pl. 12, figs. 1 and 2.

Smaller than the other fiddler crabs, somewhat cylindrical, smooth; front arched between the eyes, which are correspondingly shorter than in the other species. Large cheliped granulate, relatively smooth; fingers slender, the movable one longest, curving down past the tip of the immovable finger. Legs narrow, noticeably hairy.

Width about 20 mm.

Salt flats at Puerto Grande on the Rio Zarumilla (2 leagues from Capon), February 2, 1908. "Cangrejitos de las salineras."

Not before recorded from Peru.

Distribution.—Galapagos Islands; Peru.

HEPATUS CHILIENSIS Milne Edwards.

Plate 37, fig. 1.

Hepatus chiliensis MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 117.

Hepatus chilensis MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 28; vol. 9, atlas, 1847, pl. 14.

Of good size. Carapace broadly oval, with the postero-lateral margins concave, posterior margin narrow; surface a little uneven; margins crenulate; front narrow, truncate; orbits small, filled by the eyes; below the orbit, a concave, subtriangular area. Buccal cavity triangulate, produced nearly to antennules. Chelipeds stout, folding close to the body; hands with a superior, dentate crest and five ridges

on the outer surface; fingers not gaping; dactylus partly tuberculate above. Legs compressed, unarmed, dactyli furry above and below.

Width 70 to 85 mm.

Dredged near northeast side of San Lorenzo Island, depth $2\frac{1}{2}$ fathoms, February 5. Callao, October 29, 1907.

Distribution.—Ecuador; Peru; Chile.

HEPATELLA AMICA Smith.

Plate 50, fig. 5.

Hepatella amica SMITH, in Verrill, Amer. Nat., vol. 3, 1870, p. 250.

Carapace subrectangular, little broader than long, antero-lateral margins arched and crenulate, postero-lateral margins deeply excavate and meeting the posterior margin at an angle; antero-lateral regions depressed; gastric, cardiac and post-branchial regions elevated and granulate; front produced, subtruncate. The concave area below the orbit is very shallow and ill defined. Maxillipeds notched at tip. Chelipeds moderate; wrist and chela cristate above; upper crest of hand tridentate, lower edge crenate, four ridges on outer surface. Legs cristate above and below.

Width 16 to 20 mm.

Taken in trawl, Bay of Sechura, west of Mataballa, depth about 5 fathoms, April 8, 1907.

Not previously known from Peru.

Distribution.—Panama; Peru.

LEUCOSILIA JURINEI (Saussure).

Plate 45, fig. 1.

Guaia (ilia) jurinei SAUSSURE, Rev. et Mag. de Zool., no. 8, 1853, p. 12, pl. 13, fig. 4.

Leucosilia jurinii BELL, Trans. Linn. Soc. London, vol. 21, 1855, p. 295, pl. 32, fig. 1.

Carapace orbicular, very convex, surface closely covered with granulations; hepatic region bearing a low elevation, margin separately convex; a tooth or tubercle on the intestinal region; front with two small triangular, divergent teeth. Orbits small, three closed fissures on its margin. Buccal cavity as advanced as the front, subtriangular. Chelipeds and legs granulate; arm joints cylindrical; palms a little compressed, narrowing distally; fingers long and slender, slightly gaping in male; dactyli of legs setose, slightly curved.

Length 14 to 21 mm.

Oyster beds of Matapalo (near Capon), January 23, 1908.

Not previously known from Peru.

Distribution.—From Mazatlan, Mexico; to Peru; Galapagos Islands.

DROMIDIA SARRABUREI, new species.

Plate 48, fig. 4.

Densely covered with fur except ends of fingers and dactyli; abdomen partly extended. Carapace high, subglobular, broader than long; antero-lateral margins directed toward the buccal angles and armed with six small teeth or tubercles; from the last tooth an oblique furrow runs across the branchial region. Front vertical, tridentate. Orbits with a tooth above and below; orbits and antennular pits continuous. Maxillipeds protuberant. Chelipeds short, stout, equal; fingers deeply channeled inside, gaping at base. First and second legs broad, dactyli with a curved horny tip and a row of horny spines beneath; third and fourth legs narrower, subdorsal and prehensile, third shorter, dactyli strongly curved, fourth one recurved, both folding against a spinous process on the propodus.

Length of carapace of an ovigerous female 28.2 mm., width 30 mm.

Type-locality.—Taken in trawl, Bay of Sechura, west of Matacaballa, depth about 5 fathoms, April 8, 1907.

"Camarones del Mar." Crab housed in sponge.

Type.—Cat. No. 40475, U.S.N.M.

Dedicated to Señor Don Carlos Sarraure y Correa, Director de Fomento.

HYPOCONCHA PERUVIANA, new species.

Plate 47, fig. 2.

Covered with a coat of short setæ, margins fringed with short hair; abdomen partly extended; dorsal surface fitting the contour of the molluscan valve which it holds over itself. Carapace flattened, membranaceous; length subequal to breadth; anterior margin arcuate, with a slight median incision and notches at the insertion of the antennæ; postero-lateral margins subparallel and forming a sinus behind the lateral angle. Eyes and orbits small, wholly ventral. Antennæ long and slender. Prominences of ventral surface granulated. Chelipeds small, equal; wrist and claw granulated; outer face of wrist bordered by fringe of hair; fingers stout, not gaping, tips red. First and second legs stout; third and fourth slender, dorsal, third the shorter, dactyli very short and hooked, helping to hold the crab in place in the shell which it carries on its back.

Length of mature female 18 mm., width 19.5 mm.

Under valve of *Chione asperima* Sowerby.^a

Type-locality.—Oyster beds of Matapalo, near Capon, February 3.

Type.—Cat. No. 40474, U.S.N.M.

Near *H. digueti* Bouvier,^b from La Paz Bay, Mexico, but differs in having a Y-shaped depression on the gastric region directly in

^a All the mollusks mentioned in this paper were identified by Dr. W. H. Dall.

^b Bull. Mus. Hist. Nat., Paris, vol. 4, 1898, pp. 374 and 376.

front of the cervical suture; the margins of front and carapace granulated; the endostomial crest prominent and armed with a denticle; the wrist bordered by a prominent granulated and fringed marginal crest, except on the distal border, and a sharp spine at the infero-distal angle; the abdomen of the female with a backward-pointing fringe of hair on the posterior border of the fourth and the fifth segments.

EMERITA ANALOGA (Stimpson).

Plate 49, fig. 1.

Hippa analoga STIMPSON, Proc. Boston Soc. Nat. Hist., vol. 6, 1857, p. 85.

Hippa talpoides DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 409; atlas, 1855, pl. 25, figs. 10a-c.

Carapace oblong-oval, very convex, with fine transverse rugæ; two short transverse impressed lines on anterior half; antero-lateral margin finely serrulate. Front having three small lobes or teeth, lateral teeth more advanced than median; sinuses rounded. Eye-stalks long and slender, directed forward. Antennules twice as long as eyes. Second joint of antennal peduncle ending in three spines, of which the middle one is the largest; flagellum very long, curved and bent back under the body. Maxillipeds large, operculiform. First pair of legs not chelate, dactyli oval; dactyli of second and third pairs falcate; fifth pair of legs very slender, concealed. Abdomen partially extended; telson large, elongate-triangular, more than twice as long as wide.

Length of carapace 20 to 23 mm.

Sand beach, Ancon, February 13. Abundant. These "mui-muis" are used for bait in fishing; also the soft ones are eaten.

From sand beach, NE. side of San Lorenzo Island, January 11, 1907.

"Cameroncitos;" Mollendo, July 23 (or "mui-mui" of other places).

Distribution.—From Oregon to Chile.

EMERITA EMERITA (Linnaeus).

Plate 49, fig. 6.

Cancer emeritus LINNÆUS, Syst. Nat., 12th ed., vol. 1, pt. 2, 1767, p. 1055.

Hippa emerita DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 409; atlas, 1855, pl. 25, figs. 9a-c.

Very similar to the preceding, but larger; carapace rougher, postero-lateral expansion longer; frontal teeth longer and narrower; eyes longer, reaching beyond middle of antennules; second joint of antennal peduncle much longer, due to the great length of the middle spine; telson less than twice as long as wide.

Length of carapace 32 to 38 mm.

Ocean beach, Capon, January 29. These are called "barquillas" here, instead of "mui-muis," as corresponding forms are known generally on the coasts. They are eaten by the fishermen after boiling, but contain little meat.

Distribution.—From Lower California to Chile; from Florida to Brazil.

PAGURISTES HIRTUS Dana.

Plate 51, fig. 2.

Paguristes hirtus DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 437; atlas, 1855, pl. 28, figs. 2a-f.

A rough, hairy hermit crab; rostrum short; eyes slender, much longer than antennal acicle, shorter than base of antennule; eye scale elongate, inner margin denticulate; flagellum of outer antennæ long-ciliated below. Chelipeds equal; hand subelliptical, short-spinous and tufted hirsute, margins spinous, outer margin very arcuate. First and second pairs of legs rough and hairy, dactyli longer than propodi.

Length 50 mm.

Taken in trawl, Bay of Sechura, west of Mataballa, about 5 fathoms, April 8, 1907.

One small specimen, in *Marginella curta* Sowerby.

Distribution.—Peru; Chile.

PAGURISTES TOMENTOSUS (Milne Edwards).

Plate 50, fig. 1.

Pagurus tomentosus MILNE EDWARDS, Ann. Sci. Nat. (3), Zool., vol. 10, 1848, p. 64.

A small hermit crab, in which the base of the antennæ, the equal chelipeds and the next three pairs of feet are clothed with long, soft hair, which conceals the surface, except some sharp, black spines which border the inner edge of the wrist and hand and are scattered also on their dorsal surface; similar spines on upper edge of the ambulatories, and smaller spines on their outer surfaces. The rostral point is stronger than in *P. hirtus*, and the eyes are more cylindrical, not at all dilated at the cornea.

Length said to be 2½ inches. Our specimen is about 1 inch or 25 mm.

Dredged, Bay of Sechura, about half-way between Bayovar and Mataballa, 5 to 6 fathoms, April 10, 1907.

One specimen, in shell of *Oliva peruviana*.

Distribution.—Peru; Chile (?).

CLIBANARIUS PANAMENSIS Stimpson.

Plate 47, fig. 4.

Clibanarius panamensis STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 84.

A hermit crab with the carapace elongate, well calcified in front of the cervical groove, rostrum small, triangular. Abdomen well developed, soft, spirally coiled. Eye stalks long and slender; eye scales approximated. Antennal acicle short, flagellum long. Chelipeds similar, equal, spinous; fingers opening horizontally, tips cor-

neous and broadly hollowed. First two pairs of legs longer than chelipeds, and like them, finely striped longitudinally with red and white. Third and fourth pairs of legs small, third subcheliform, fourth cheliform. Abdomen having an appendage on left side of second, third, fourth, and fifth segments; tail-fan present, more developed on left side.

Length of carapace about 20 mm.; entire length of extended crab about 85 mm.

Isla de la Correa, near Capon, January 25, 1908. "Diablicas." The native method of extracting the "diablicas" from the shell is to apply a coal of fire to the apex, until the animal voluntarily abandons his house. They are said to be as palatable as the "camerones" (shrimps).

Distribution.—From Lower California to Peru.

DARDANUS SINISTRIPES (Stimpson).

Plate 49, fig. 2.

Pagurus sinistripes STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 82.

A hermit crab with carapace elongate, partially calcified anteriorly; rostrum absent; a tooth at base of antenna. Abdomen soft, spirally coiled. Eye stalks stout; eye scales large and well separated. Antennal scale moderate, flagellum long. Chelipeds dissimilar, left the larger; spinous; fingers opening in an obliquely vertical plane; tips corneous, somewhat spooned. Next two legs long and spinous; the second one on the left side is unlike the others, the last two segments much broadened, covered outside with overlapping scales, propodus with a longitudinal ridge, the dactylus with a deep furrow. Last two legs small, third subchelate, fourth chelate. Abdominal appendages similar to those of *Clibanarius*; behind the third one, but more ventral, there is a fleshy spur.

Length of animal extended, about 80 mm.; length of carapace about 20 mm.

In a species of *Natica*.

Dredged, Bay of Sechura, about half-way between Bayovar and Mataraballa, in 5 to 6 fathoms, April 10, 1907.

Distribution.—From Lower California to Peru.

DARDANUS IMBRICATUS, new species.

Plate 49, fig. 3.

Similar to the preceding; eye stalks shorter, eye scales not spreading at the extremity; antennal scale just reaching the cornea. Left cheliped the larger, with wrist sparsely spinous, palm broader than long, outer face covered with numerous fan-shaped, overlapping scales which are largest near the immovable finger; scales bordered distally by small chalky-white granules and a fringe of short hair;

dactylus similarly ornamented, except for a row of tubercles next to the prehensile teeth. Right cheliped wanting, as are also the left ambulatory legs. Right ambulatories nearly smooth, long, hairy; dactyli somewhat shorter than in *D. sinistripes*.

Length of carapace 18 mm., length of body about 70 mm.

One specimen lacking the right cheliped, in shell of *Thais chocolata* Duclos.

Dredged, Bay of Sechura, about half-way between Bayovar and Matacaballa, 5 to 6 fathoms, April 10, 1907.

Type.—Cat. No. 40470, U.S.N.M.

? *PAGURUS BENEDICTI* (Bouvier).

Plate 48, fig. 1.

Eupagurus minutus BENEDICT, Proc. U. S. Nat. Mus., vol. 15, 1892, p. 14 (not *Pagurus minutus* HESS, 1887).

Eupagurus benedicti BOUVIER, Bull. Mus. Hist. Nat., Paris, 1898, p. 381.

A small, somewhat hairy, hermit crab with front nearly straight, faintly three-lobed; eye stalks long, stout; scales short, rounded, with a slender subterminal spine; acicle of antenna shorter than eye, peduncle scarcely longer than eye. Chelipeds dissimilar, unequal, right larger; its wrist triangular above, inner margin armed with slender spines, a few scattered spines on the surface; chela suboval, inner margin set with long slender spines; spines of outer margin smaller, two rows of spines beginning at carpus converge at base of pollex, other scattered spines; wrist of smaller cheliped with two rows of spines, upper face and oblique outer face of chela subequal, the latter bordered by sharp spines. Ambulatory legs slender, longer than chelipeds.

Total length reaches 33 mm. The single Peruvian specimen is very small, about 15 mm., and bears eggs. It is placed here with some doubt.

The ambulatories show broad bands of red and white, one of each color on the propodus and the dactylus, the white distal to the red.

Dredged near the northeast side of San Lorenzo Island, depth 2½ fathoms, February 5.

Not previously known from Peru.

Distribution.—Gulf of California; Peru.

CALLIANASSA UNCINATA Milne Edwards.

Plate 45, fig. 3.

Callianassa uncinata MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 310, pl. 25bis, figs. 1-3.

A burrowing shrimp with submembranaceous shell; carapace small, oblong-oval, rostrum minute. Eye stalks flat, triangular, with small dorsal cornæ. Inner antennæ stout, peduncle as long as flagella;

outer antennæ without scale, flagellum longer than carapace. Outer maxillipeds operculiform. First, second, and fourth pairs of feet chelate, those of first pair largest, unequal, flattened, smooth, and hard; the larger one with arm small, wrist very large, palm of equal width, hollowed out distally next the immovable finger and having a tooth projecting into the wide gape; movable finger with a truncate tooth at its base, extremity hooked; smaller cheliped of first pair much narrower; propodus of third pair obliquely oval. First segment of abdomen narrow; tail-fan broad, telson squarish.

Length of body about 7 cm. The Peruvian specimens are small, about 17 mm. long. The wrist is proportionately longer than in Milne Edwards's figure and the tooth on the dactyl of the large claw broader.

Living in the muddy sand of the inside beach at Capon.

Not previously known from Peru.

Distribution.—Peru; Chile.

PETROLISTHES ARMATUS (Gibbes).

Plate 41, fig. 3.

Porcellana armata GIBBES, Proc. Amer. Ass. Adv. Sci., vol. 3, 1850, p. 190.

Porcellana gundlachi GUÉRIN, in La Sagra's Hist. Cuba, vol. 8 (atlas), 1855, Articulata, pl. 2, fig. 6.

Small. Carapace ovate, finely rugose; a spinule on lateral margin behind hepatic sinus. Front triangular, undulated. Eye stalks short and stout, cornea large. Flagellum of antenna much longer than body. Maxillipeds very large, projecting beyond the front. Chelipeds broad and flat, subequal but unlike; wrist long, tridentate on anterior margin, two or three spines at distal end of posterior margin; palm triangular, widening distally; fingers shorter than palm, slightly gaping in the stouter chela. First three pairs of legs half as long as chelipeds; merus joints flattened, spinous; following joints slender. Last pair of legs much slenderer, inflexed. Abdomen symmetrical, bent under the body, sixth segment bearing a pair of lamellar appendages, which with the telson form a swimming fan.

Width 7 to 8 mm.

Taken on the beach at Las Vacas, near Capon, January 23, 1908. "Salamandra." These crabs are found in vast abundance on the shelly oyster banks bordering the mangrove swamps at Matapalo. The bank is exposed at low tide for a width of about 25 meters. By scratching in the shelly ground many of these crabs can be taken.

Oyster beds of Matapalo (near Capon), January 23, 1908, from masses of sponge.

Not previously known from Peru.

Distribution.—From Lower California to Peru; from Florida to Brazil; Bermudas; Indo-Pacific region.

PETROLISTHES SPINIFRONS (Milne Edwards).

Plate 48, fig. 5.

Porcellana spinifrons MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 256.

Similar in shape to the preceding. Carapace rougher, areolated; antero-lateral margin denticulated. Front quinquedentate, middle tooth largest and most prominent, intermediate pair on lower level. Orbits better defined and eyes smaller than in *P. armatus*. Peduncular segments of antenna tuberculate; flagellum very long. Maxillipeds also long. Chelipeds shorter than in the preceding; a strong tooth at middle of anterior margin of wrist; palms as broad as long; fingers as long as palm. First three pairs of legs stout; fourth pair shorter and a little broader than in *P. armatus*.

Width 10 mm.

Peacadores Islands, February 12. Small, dark purple crab.

Distribution.—Peru; Chile.

PACHYCHELES GROSSIMANUS (Guérin).

Plate 46, fig. 5.

Porcellana grossimana GUÉRIN, Bull. Soc. Sci. Nat. France, 1835, p. 116; Mag. de Zool., vol. 8, 1838, cl. 7, pp. 6, 8, pl. 26, fig. 3.

Allied to *Petrolisthes*. Carapace ovate, as broad as long, convex, faintly rugose. Front bluntly tridentate, orbits shallow, eyes large. First article of antenna reaches margin of carapace; flagellum longer than carapace. Maxillipeds visible in dorsal view. Chelipeds very broad and thick, rough and setose; wrist broader than long, two teeth on anterior margin; palms as broad as long; outer margin of propodus very convex; fingers gaping, densely hairy within. First three pairs of legs stout and hairy; fourth pair slender, inflexed.

Width 8 to 12 mm.

Taken in trawl, Bay of Sechura, west of Mataballa, depth about 5 fathoms, April 8, 1907.

Taken from seaweed, Chincha, North Island, June 18, 1907.

Distribution.—Peru; Chile.

MUNIDA COKERI, new species.

Plate 53, fig. 5.

Grimotea gregaria GUÉRIN, Voy. Coquille, atlas, 1830, pl. 3, fig. 1 (colored); vol. 2, pt. 2, 1831, p. 32 (not *Galathea gregaria* FABRICIUS, 1793).

Carapace oblong; abdomen partly extended; chelipeds elongate, longitudinal, as are also the first three pairs of legs; last pair of legs very slender, inflexed. Cervical suture deep; numerous transverse striæ bordered by setæ; rostrum a slender spine, longer than eyes,

its upper margin and the extremities of its lower and lateral margins very finely denticulate; a short spine on either side of the base of the rostrum, and also at antero-lateral angles; a few spinules on anterior side margin. Corneæ large, reniform. Chelipeds narrow, not twice length of carapace, rough with spinules; spines at distal angles of arm and wrist; palm twice as long as wide, fingers longer than palm, not gaping. First three legs rough, margins hairy. Abdomen transversely striated and ciliated, unarmed; swimming fan broad.

Length of carapace of type male 18.8 mm., length of entire animal extended 60 mm.

Lobos de Afuera, March, 1907. "Cameron del Mar."

"Camerones del Mar" (red), casually very abundant, Callao Bay, June, 1908.

Type-locality.—Callao Bay.

Type.—Cat. No. 40484, U.S.N.M.

Guérin^a says that this species is so abundant in the roadstead of Callao that it gives the water the appearance of blood.

PANULIRUS ORNATUS (Fabricius).

Plate 52, fig. 1.

Palinurus ornatus FABRICIUS, Ent. Syst., Suppl., 1798, p. 400.

Palinurus fasciatus DE HAAN, Fauna Japon., Crust., 1849, p. 159, pls. 43, 44, fig. 2.

A large lobster with carapace longitudinally subcylindrical and spinous; orbits partially excavated; eyes stout; a long horn-like spine behind each eye. Flagella of first antennæ long and slender, the segment that carries them produced considerably in advance of the frontal margin and bearing four spines. Second antennæ subcylindrical, with strong, spinous, peduncular segments and long, rigid multi-articulate flagella. Five pairs of legs similar, third longest; not chelate, except fifth pair in female which is subchelate; tips horny. First to sixth abdominal segments nearly smooth, produced laterally to a spine; swimming fan spinulous.

Length of body about 25 cm.; length including antennæ about 56 cm.

Payta, April 27, 1907. "Langosta."

Not previously known from Peru.

Distribution.—From Lower California to Peru; Indo-Pacific region.

BITHYNIS CÆMENTARIUS GAUDICHAUDII (Milne Edwards).

Plate 54, fig. 1.

Palæmon gaudichaudii MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 400.

Palæmon gaudichaudii MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, 1843, p. 37; vol. 9, atlas, 1847, pl. 17, fig. 2.

A river shrimp or prawn of large size. Body smooth, subcylindrical; abdomen diminishing posteriorly; first two pairs of legs chelate,

^a Voy. Coquille, vol. 2, pt. 2, 1831, p. 32.

second pair very large, unequal. Rostrum short, triangular, with a superior crest, dental formula $\frac{1}{1}:\frac{1}{1}$. A spine on anterior margin of carapace just outside orbital sinus. Inner antenna with three slender flagella; outer antenna with a large scale and a very long flagellum, dorso-ventrally flattened. First pair of legs slender; second pair stout, spinous, the smaller one as long as the body, the larger one one and a half times as long, palm compressed, wider than wrist; last three pairs simple, spinulose. Telson subtriangular, with two pairs of dorsal spinules, extremity rounded.

Length of body 16 cm.; total length to end of large claw 37 cm.

Taken at Pacasmayo from a small and rather dirty stream which flows through the town, conveying to the bay the surplus water from irrigation ditches supplied from the River Jequetepeque, March 12, 1907; common.

Market of Lima, November 2, 1907.

Market of Lima, April, 1908. The seller stated that they were brought from Chancay.

Market of Lima, April, 1908. Presumably from the Rimac.

Taken in the Rimac near Villegas (below Lima), November 6, 1907.

Arequipa, July 26, 1908.

Mollendo, July 23, 1908.

Distribution.—From Ecuador to Chile.

MACROBRACHIUM JAMAICENSE (Herbst).

Plate 51, fig. 1.

Cancer (Astacus) jamaicensis HERBST, Natur. Krabben u. Krebse, vol. 2, 1792, p. 57, pl. 27, fig. 2.

Similar to the preceding; rostrum narrower and longer, about as long as peduncles of inner antennæ, teeth $\frac{1}{1}:\frac{1}{1}$; an additional spine on the carapace behind the marginal spine. Chelipeds of second pair equal, spinous; palm slightly compressed, scarcely wider than carpus and more than three times as long as wide.

This species may attain the size of the preceding, but the Peruvian specimens are small, body not exceeding 7 cm.

Taken at Pacasmayo from a small and rather dirty stream which flows through the town, conveying to the bay the surplus water from irrigation ditches supplied from the River Jequetepeque, March 12, 1907; common.

Not previously known from Peru.

Distribution.—Fresh waters of the Pacific slope of America from Lower California to Peru; and of the Atlantic slope from Texas to Brazil, including the West Indies.

?PALÆMON RITTERI Holmes.

Plate 53, fig. 1.

Palæmon ritteri HOLMES, Proc. Cal. Acad. Sci. (2), vol. 4, 1895, p. 579, pl. 21, figs. 29-35.

A small shrimp, allied to *Macrobrachium*, with smooth carapace, armed with two spines on each side of the anterior margin; rostrum

long, thin, acuminate, teeth $2\frac{1}{3}$. Antennal scale about as long as rostrum. All the legs slender; second or larger cheliped smooth, reaching well beyond the rostrum.

One specimen only was taken by Doctor Coker, and differs from North American specimens in having the rostrum more arched above and not exceeding antennal scale; the second pair of feet extending beyond rostrum by length of chela; its carpus longer than one-half of merus and longer than palm. As the species of *Palæmon* are very variable, I refrain from making a new species on a single specimen.

Length of body of Peruvian individual 23 mm.

From salt creeks at La Palisada near Tumbes, February 12, 1908.

Not previously known from Peru.

Distribution.—San Diego, California; Lower California; Ecuador; Peru.

RHYNCHOCINETES TYPUS Milne Edwards.

Plate 52, fig. 2.

Rhynchocinetes typus MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 383.—

MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, 1843, p. 36; vol. 9, atlas, 1847, pl. 17, fig. 1.

A shrimp of medium size, in which the large lamellate rostrum is articulated with the carapace; seven spines on anterior margin of carapace, of which the median spine is followed by another farther back. Rostrum bent strongly upward; superior margin armed with two spines near the base and seven or eight denticles near the end; inferior margin with about twenty teeth. Eyes short, stout. Inner antennæ biflagellate; scale of outer antennæ long and narrow, flagellum as long as body. First and second legs chelate; first stout, a spine at end of arm and wrist; third, fourth, and fifth legs similar, spinulous beneath, third longest of all. Telson long and narrow, three pairs of dorsal spinules.

Length 11 cm.

Lobos de Afuera, March 22. "Cameron del Mar."

Not previously known from Peru.

Distribution.—Peru; Chile; New Zealand; Australia; Indian Ocean.

SYNALPHEUS LATASTEI Coutière.

Synalpheus latastei COUTIÈRE, Proc. U. S. Nat. Mus., vol. 36, 1909, p. 25, text fig. 7.

Small shrimps having one very heavy claw, attached by slender segments to the body. Eyes covered by the translucent carapace. A small rostral spine and a similar shorter spine on each side in front of eye. Outer antennæ with a strong scale bearing a subapical spine; inner antennæ with a large spine attached to its basal joint. Legs of first pair unequal and unsymmetrical, larger chela suboval, somewhat

twisted, unarmed; fingers broad, especially the dactylus, locking together, tips corneous. Second legs slender, chelate; carpus 5-articulate, first article equal to sum of other four; second, third, and fourth articles small, subequal; last three legs simple.

Length of body about 30 mm., in Peruvian specimens about 20 mm.

Taken in trawl, Bay of Sechura, west of Mataballa, depth about 5 fathoms, April 8, 1907.

Not previously known from Peru.

Distribution.—Peru; Chile; Australia?

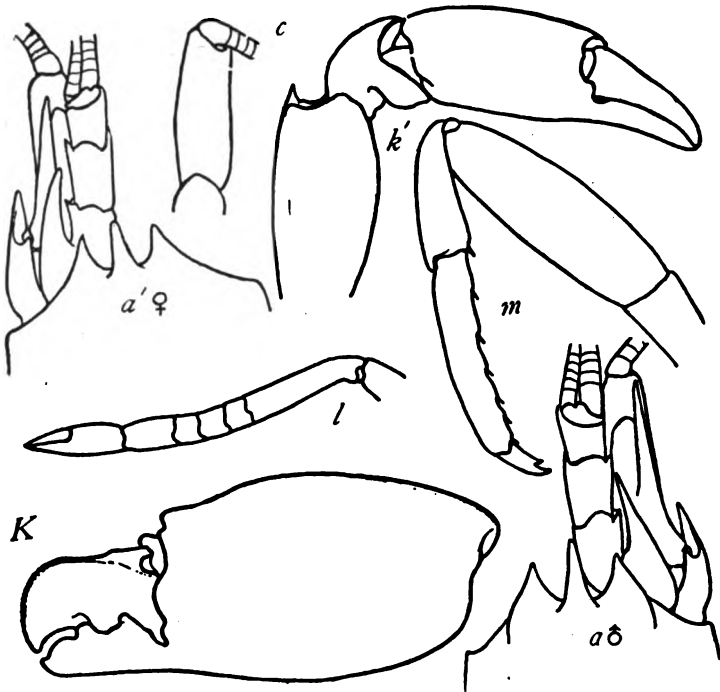


FIG. 3.—*SYNALPHEUS LATASTEI*. AFTER COUTIÈRE. *a*, FRONTAL AND ANTENNAL REGION, MALE, AUSTRALIA; *a'*, FRONTAL AND ANTENNAL REGION, FEMALE, CHILE; *c*, CARPOCERITE; *K*, LARGE CHELA; *k'*, SMALL CHELIPED OF FIRST PAIR; *l*, FOOT OF SECOND PAIR; *m*, FOOT OF THIRD PAIR.

***SYNALPHEUS TOWNSENDI PERUVIANUS*, new subspecies.**

Plate 53, fig. 4.

Similar in form to the preceding. Rostral spine slender, exceeding slightly the frontal spines. Antennular peduncle very long; first segment exceeds rostrum by a distance equal to length of second segment; second segment one and a half times third; stylocerite reaching middle of second segment. Antennal peduncle overreaching slightly the antennular peduncle; scale reaching end of antennular peduncle; basicerite unarmed above, lateral spine reaching middle of first antennular segment. Palm of larger claw ending in a curved

spine. Distal angles of telson rectangular; inner spine more than twice as long as outer spine.

Length of body of ovigerous female 19.5 mm.

The elongate antennular peduncles, which are about half as long as carapace, serve to distinguish this form at once from the typical form of *S. townsendi* Coutière.^a

Type-locality.—Oyster beds of Matapalo (near Capon), January 23, 1908.

Type.—Cat. No. 40503, U.S.N.M.

PENEUS STYLIROSTRIS (Stimpson.)

Plate 53, fig. 2.

Penæus stylirostris STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 134.

Body strongly compressed; carapace carinated; a spine on anterior margin and one behind it; rostrum long and slender, reaching beyond antennular peduncles, teeth $3\frac{1}{2}$, no teeth above near the extremity. Eyes very large, sunk in the hollowed antennules. Antennular flagella longer than peduncle; inner flagellum much longer than outer. Antennal flagella twice as long as body. Legs slender, first three pairs chelate. Fifth and sixth segments of abdomen carinate; telson narrow-triangular, furrowed, unarmed, greatly exceeded by appendages of sixth segment.

Length about 15 cm., of Peruvian specimens 4 to 5 cm.

From salt creeks at La Palisada near Tumbes, February 12, 1908. "Camerones del Mar."

Not previously known from Peru.

Distribution.—Panama; Peru.

PENEUS BREVIROSTRIS Kingsley.

Plate 54, fig. 2.

Penæus brevirostris KINGSLEY, Proc. Acad. Nat. Sci. Phila., 1878, p. 98.

Penæus californiensis HOLMES, Occas. Papers Cal. Acad. Sci., vol. 7, 1900, p. 218, pl. 4, figs. 64-69.

Similar to the preceding. The carina of the carapace is accented by a groove on either side extending its whole length; on the carapace, in addition to the two spines of *P. stylirostris*, there is a small marginal spine above the eye and a short crest running back from it. Rostrum shorter than antennular peduncles, teeth $2\frac{1}{2}$, tip unarmed. Antennular flagella scarcely longer than peduncle; inner flagellum shorter than outer. Antennal flagellum not twice as long as body. Fourth, fifth, and sixth segments of abdomen carinate.

The body attains a length of 19 cm. Peruvian specimens are about 11 cm.

^a Proc. U. S. Nat. Mus., vol. 36, 1909, p. 32, text fig. 14.

Taken in trawl, Bay of Sechura, west of Mataballa, depth about 5 fathoms, April 8, 1907. "Camerones del Mar."

Not previously known from Peru.

Distribution.—From San Francisco Bay, California, to Peru; Galapagos Islands.

CHLORIDELLA DUBIA (Milne Edwards).

Plate 54, fig. 3.

Squilla dubia MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 522.

A stomatopod or mantis shrimp. Carapace small, not covering the last four segments of the thorax; rostrum oblong-triangular; eye stalks dilated, corneæ oblique, corneal shorter than peduncular axis; first five pairs of thoracic limbs serving as accessory mouth parts, the second pair strongly developed into large raptorial limbs in which the dactylus bears six spines and closes on the manus like the blade of a penknife; last three pairs of thoracic limbs ambulatory, bearing a lateral appendage on the penult segment; lateral spine of fifth thoracic segment curved. Abdomen large, its first five segments carry tufted gills on the exopods, and have eight longitudinal dorsal carinæ; swimming fan large; telson wider than long, with a median crest and a row of pits on each side; six marginal spines, intervening denticles 1-3, 3-4, 1; basal process of uropods two-spined, inner spine longer.

Length 12 to 13 cm.

Mouth of River Tumbes, January 15, 1908. "Cameron brujo" (=the wizard shrimp). The "cameron brujo" is much feared by the fishermen and is said to inflict a very severe wound. My guide received a bad wound in the foot while wading, and attributed it to a "cameron brujo." Exopodite and endopodite of last pair of abdominal limbs (uropods) red.

Taken in casting net at mouth of river Tumbes (Isla Santa Lucia), January 15, 1908. Color olivaceous, barred with red. A broad red bar on each segment of thoracic and abdominal regions, this color being especially deep on the six longitudinal ridges. Telson mainly red, bluish in median region, the margin white, with a band of blue just interior to the white. Cephalic shield olivaceous, with narrow red streaks on the longitudinal ridges. "Arms" bluish.

Distribution.—Ecuador; Peru; also South Carolina and Georgia.

PSEUDOSQUILLA LESSONII (Guérin).

Plate 52, fig. 3.

Squilla lessonii GUÉRIN, Voy. Coquille, Atlas, Crust., 1830, pl. 4, fig. 1.

Squilla cerisii GUÉRIN, Voy. Coquille, vol. 2, pt. 2, 1831, p. 40.

A mantis shrimp, with body more cylindrical than the preceding; rostrum pentagonal, three-spined; corneal greater than peduncular axis; dactylus of raptorial limb three-spined; no spine on fifth thoracic segment. First five abdominal segments smooth; telson

with median crest and ten other carinæ; submedian spines with movable tips; denticles 0, 2, 1; basal process of uropods three-spined, outer spine longest.

Length 13 to 13½ cm.

Callao, January 29, 1907.

Distribution.—From Wilmington, California, to Chile.

LYSIOSQUILLA DECEMSPINOSA, new species.

Plate 53, fig. 3.

A mantis shrimp with depressed body; rostrum transversely oblong, with a median spine, anterior angles produced. Eye stalks short, stout, cylindrical; corneæ globular. Dactylus of raptorial claw with ten spines. Abdomen dorsally smooth; six marginal spines on telson; intermediate denticles, 9, 1, 0, almost concealed in dorsal view by the overhanging margin; basal prolongation of uropods armed with two long spines.

Length about 24 mm.

Near *L. armata* Smith,^a which is larger and has a different arrangement of spines on the telson.

Type-locality.—Capon.

Living in vertical holes in the muddy sand of the inside beach at Capon. Small yellow eggs were often noted attached to the sides of the holes. January 30, 1908.

Type.—Cat. No. 40498, U.S.N.M.

LIST OF THE PRINCIPAL WORKS RELATING TO THE STALK-EYED CRUSTACEAN FAUNA OF THE PERUVIAN PROVINCE.

BELL, THOMAS. On *Microhynchus*, a new Genus of Triangular Crabs. *Proc. Zool. Soc. London*, vol. 3, 1835 (published Sept. 25, 1835), p. 88.

— Observations on the Genus *Cancer* of Dr. Leach (*Platycarcinos*, Latr.), with Descriptions of three New Species. *Proc. Zool. Soc. London*, vol. 3, 1835 (published Sept. 25, 1835), pp. 86-88.

— Observations on the Genus *Cancer* of Dr. Leach (*Platycarcinus*, Latr.), with Descriptions of three new Species. *Trans. Zool. Soc. London*, vol. 1, 1835, pp. 335-342, pls. 43-47. Quarto.

— Some Account of the *Crustacea* of the Coasts of South America, with Descriptions of New Genera and Species; founded principally on the Collections obtained by Mr. Cuming and Mr. Miller (Tribus 1, *Oxyrhynchi*). *Proc. Zool. Soc. London*, vol. 3, 1835 (published Feb. 24, 1836), pp. 169-173.

— Some Account of the *Crustacea* of the Coasts of South America, with Descriptions of new Genera and Species: founded principally on the Collections obtained by Mr. Cuming and Mr. Miller. *Trans. Zool. Soc. London*, vol. 2, 1836, pp. 39-66, pls. 8-13. Quarto.

BOUVIER, E.-L. Crustacés décapodes nouveaux recueillis à Païta (Pérou) par M. le Dr. Rivet. *Bull. Mus. hist. nat.*, Paris, 1907, no. 2, pp. 113-116, text figs. 1-3.

— *Arctus delfini* Sp. Nov. *Revista Chilena Hist. Nat.*, vol. 13, 1909, pp. 213-215, text fig. 30.

CANO, GAVINO. Crostacei Brachiuri ed Anomuri raccolti nel viaggio della *Vettor Pisani* intorno al globo. *Boll. Soc. Nat. Napoli* (1), vol. 3, 1889, pp. 79-105, 169-268.

^a See Bigelow, *Proc. U. S. Nat. Mus.*, vol. 17, 1894, p. 503.

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APPROXIMATE LATITUDES OF PERUVIAN LOCALITIES MENTIONED IN THIS PAPER.

Capon, Matapalo, Puerto Grande, Las Vacas, Salto, mouth of Río de Tumbes (Tumbes); also Boca Alamo, La Palisada, and Isla Santa Lucia.	3° 30' S.
Zorritos.....	3 50 S.
Paita (Payta) and Caleta Colon.....	5 00 S.
Sechura Bay; also Mataballa and Bayovar.....	5 40 S.
Lobos Islands, northern (Lobos de Tierra).....	6 30 S.
Lobos Islands, southern (Lobos de Afuera).....	7 00 S.
Pacasmayo.....	7 20 S.
Chimbote Bay (or Ferrol Bay).....	9 05 S.
Ancon and Pescadores Islands.....	11 45 S.
Callao, Lima, La Punta, and San Lorenzo Island; also mouth of the Rimac.	12 04 S.
Bay of Chilca.....	12 30 S.
Pisco and Chincha Islands.....	13 45 S.
Independencia Bay.....	14 15 S.
Arequipa.....	16 20 S.
Mollendo.....	17 00 S.

LIST OF SPECIES OCCURRING FROM PANAMA TO THE ISLAND OF CHILOË.

Class CRUSTACEA.

Order DECAPODA.

Tribe BRACHYGNATHA.

Family HYMENOSOMIDÆ.

Genus HALICARCINUS White.

HALICARCINUS PLANATUS (Fabricius).

Cancer planatus FABRICIUS, Ent. Syst., vol. 2, 1793, p. 446.—*Hymenosoma* ? *tridentatum* JACQUINOT, in Hombrón and Jacquinot, Voy. au Pôle Sud, Zool., vol. 3, 1852(?), Crust., p. 60; atlas of zool., pl. 5, figs. 27–33 (*tridentata*). Chile to Straits of Magellan; Antarctic region.

Family INACHIDÆ.

Subfamily INACHINÆ.

Genus STENORYNCHUS Lamarck.

STENORYNCHUS DEBILIS (Smith).

Leptopodia sagittaria MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 3; vol. 9, atlas, 1847, pl. 4, fig. 3 (not *L. sagittaria* LEACH).—*Leptopodia debilis* SMITH, Ann. Rept. Peabody Acad. Sci. for 1870 (1871), p. 87. Lower California to Chile; Galapagos Islands. Low-water mark to 31 fathoms.

Genus PODOCHELA Stimpson.

PODOCHELA MARGARITARIA Rathbun.

Proc. Wash. Acad. Sci., vol. 4, 1902, p. 283, pl. 12, fig. 12. Galapagos Islands, on reef and at 12 fathoms.

Genus INACHOIDES Milne Edwards and Lucas.

INACHOIDES MICRORHYNCHUS Milne Edwards and Lucas. See page 533.^a

Peru; Chile.

INACHOIDES INORNATUS A. Milne Edwards.

Jour. Mus. Godeffroy, vol. 4, 1873, p. 77. Valparaiso ^b (Ortmann).

INACHOIDES LÆVIS Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 192. Panama.

^aThis and similar citations refer to preceding pages of this paper.

^bA. Milne Edwards gives for the locality "les îles Viti," but Ortmann, Zool. Jahrb. Syst., vol. 7, 1893, p. 38, says that the original specimen is labeled "Valparaiso."

Genus EURYPODIUS Guérin.

EURYPODIUS LATREILLII Guérin.

Mém. Mus. Hist. Nat. Paris, vol. 16, 1828, p. 354, pl. 14. From Peru via Straits of Magellan to Rio de Janeiro, Brazil; Falkland Islands.

Genus DASYGIIUS Rathbun.

DASYGIUS GIBBOSUS (Bell).

Microrhynchus gibbosus BELL, Proc. Zool. Soc. London, vol. 3, 1835, p. 88; Trans. Zool. Soc. London, vol. 2, 1836, p. 41, pl. 8, fig. 1. Galapagos Islands, 6 fathoms.

DASYGIUS DEPRESSUS (Bell).

Microrhynchus depressus BELL, Proc. Zool. Soc. London, vol. 3, 1835, p. 88; Trans. Zool. Soc. London, vol. 2, 1836, p. 42, pl. 8, fig. 2. Gulf of California; Galapagos Islands. 6 to 26½ fathoms.

DASYGIUS TUBERCULATUS (Lockington).

Inachus tuberculatus LOCKINGTON, Proc. Cal. Acad. Sci., vol. 7, 1876 (1877), p. 30.—*Dasygyius tuberculatus* RATHBUN, Harriman Alaska Exped., vol. 10, 1904, p. 172, pl. 10, figs. 3, 3a, text fig. 92. From Alamitos Bay, California, to Panama Bay. 4 to 33 fathoms.

Subfamily ACANTHONYCHINÆ.

Genus EPIALTUS Milne Edwards.

EPIALTUS DENTATUS Milne Edwards.

Hist. Nat. Crust., vol. 1, 1834, p. 345. Panama (?); Peru; Chile; western Patagonia.

EPIALTUS MARGINATUS Bell. See page 534.

Galapagos Islands; Peru to Chile; Rio de Janeiro (?).

EPIALTUS BITUBERCULATUS Milne Edwards.

Hist. Nat. Crust., vol. 1, 1834, p. 345, pl. 14, fig. 11.—A. MILNE EDWARDS, Crust. Rég. Mex., 1878, p. 139, pl. 27, figs. 1-3. Southern California to Chile; Florida to Rio de Janeiro.

Genus-LEUCIPPA Milne Edwards.

LEUCIPPA PENTAGONA Milne Edwards.

Ann. Soc. Ent., France, vol. 2, 1833, p. 517, pl. 18B, figs. 1 and 2 (*pantagona*). Magdalena Bay, Lower California; from Chile to Rio de Janeiro. To a depth of 52 fathoms.

Genus ACANTHONYX Latreille.

ACANTHONYX PETIVERII Milne Edwards. See page 534.

Cape St. Lucas to Chile; Galapagos Islands; east coast of tropical America.

Genus **EUPLEURODON** Stimpson.**EUPLEURODON TRIFURCATUS** Stimpson. See page 535.

Cape St. Lucas, Lower California; Peru.

Subfamily **PISINÆ**.Genus **CHIONÆCETES** Krøyer.**CHIONÆCETES CHILENSIS** Streets.

Proc. Acad. Nat. Sci. Phila., 1870, p. 106. Chile.

Genus **LIBIDOCLÆA** Milne Edwards and Lucas.**LIBIDOCLÆA GRANARIA** Milne Edwards and Lucas.

D'Orbigny's Voy. Amér. MÉR., vol. 6, pt. 1, 1843, p. 8; vol. 9, atlas, 1847, pl. 3, fig. 1; pl. 4, fig. 1. Valparaiso, Chile.

Genus **PISOIDES** Milne Edwards and Lucas.**PISOIDES TUBERCULOSUS** Milne Edwards and Lucas.

D'Orbigny's Voy. Amér. MÉR., vol. 6, pt. 1, 1843, p. 11; vol. 9, atlas, 1847, pl. 5, fig. 1. Chile.

PISOIDES EDWARDSII (Bell).*Hys edwardsii* BELL, Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 171; Trans. Zool. Soc. London, vol. 2, 1836, p. 49, pl. 9, fig. 5. Panama; Galapagos Islands; Chile; Straits of Magellan.Genus **NOTOLOPAS** Stimpson.**NOTOLOPAS LAMELLATUS** Stimpson.Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 97.—MIRS, *Challenger* Rept., Zool., vol. 17, 1886, pp. 64 and 65, pl. 8, fig. 1c. Manzanillo, Mexico, to Panama.Genus **PELIA** Bell.**PELIA PULCHELLA** Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 170; Trans. Zool. Soc. London, vol. 2, 1836, p. 45, pl. 9, fig. 2. Galapagos Islands, 6 fathoms.

PELIA PACIFICA A. Milne Edwards.

Crust. Rég. Mex., 1875, p. 73, pl. 16, fig. 3. Magdalena Bay (?), Lower California; Panama.

Genus **LIBINIA** Leach.**LIBINIA ROSTRATA** Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 169; Trans. Zool. Soc. London, vol. 2, 1836, p. 42, pl. 8, fig. 3. Peru, 5 fathoms.

LIBINIA SPINOSA Milne Edwards.

Guérin's Icon., Crust., pl. 9, fig. 3; Hist. Nat. Crust., vol. 1, 1834, p. 301. Chile, rare (Nicolet); Patagonia; Argentina; Brazil.

LIBINIA SUBSPINOSA Streets.

Proc. Acad. Nat. Sci. Phila., 1870, p. 105. Chile.

Genus **HERBSTIA** Milne Edwards.**HERBSTIA EDWARDSII** Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 170; Trans. Zool. Soc. London, vol. 2, 1836, p. 46, pl. 9, fig. 3. Galapagos Islands, 6 fathoms.

HERBSTIA PYRIFORMIS (Bell).

Rhodia pyriformis BELL, Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 170; Trans. Zool. Soc. London, vol. 2, 1836, p. 44, pl. 9, fig. 1. Galapagos Islands, 6 fathoms.

Genus **LISSA** Leach.**LISSA AURIVILLIUSI** Rathbun.

Proc. U. S. Nat. Mus., vol. 21, 1898, p. 575, pl. 41, fig. 4. Off Lower California, 12 to 31 fathoms; Galapagos Islands, on reef.

Subfamily **SCHIZOPHRYSINÆ**.Genus **PARAMITHRAX** Milne Edwards.**PARAMITHRAX PERONII** Milne Edwards.

Paramithrax peronii MILNE EDWARDS, Hist. Nat. Crust., vol. 1, 1834, p. 324.—JACQUINOT and LUCAS, Voy. au Pôle Sud, Zool., vol. 3, 1853, Crust., p. 10, pl. 1, fig. 3. Juan Fernandez; Australia; New Zealand.

Genus **TYCHE** Bell.**TYCHE LAMELLIFRONS** Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 173; Trans. Zool. Soc. London, vol. 2, 1836, p. 58, pl. 12, fig. 3. Gulf of California, 7 fathoms; Panama.

Genus **PITHO** Bell.**PITHO SEXDENTATA** Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 172.—*Othonia sex-dentata* BELL, Trans. Zool. Soc. London, vol. 2, 1836, p. 56, pl. 12, fig. 1. Cape St. Lucas, Lower California; Galapagos Islands.

PITHO QUINQUEDENTATA Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 172.—*Othonia quinque-dentata* BELL, Trans. Zool. Soc. London, vol. 2, 1836, p. 57, pl. 12, fig. 2. Gulf of California to Panama; Galapagos Islands; Payta, Peru (?).

Genus MACROCŒLOMA Miers.

MACROCŒLOMA VILLOSUM (Bell).

Pericera villosa BELL, Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 173; Trans. Zool. Soc. London, vol. 2, 1836, p. 59, pl. 12, fig. 4. Cape St. Lucas, Lower California; Bay of Guayaquil, Ecuador.

Genus STENOCIONOPS Leach.

STENOCIONOPS OVATA (Bell).

Pericera ovata BELL, Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 173; Trans. Zool. Soc. London, vol. 2, 1836, p. 60, pl. 12, fig. 5. Galapagos Islands, 6 fathoms.

Genus MICROPHRYS Milne Edwards.

MICROPHRYS WEDDELLI Milne Edwards.

Microphrys weddelli MILNE EDWARDS, Ann. Sci. Nat. (3), Zool., vol. 16, 1851, p. 251 [31], pl. 10, figs. 1 and 2.—*Microphrys weddellii* A. MILNE EDWARDS, Crust. Rég. Mex., 1873, pl. 14, figs. 1, 1c; 1875, p. 60. Ecuador; Peru; Guadeloupe.

MICROPHRYS PLATYSOMA (Stimpson). See page 535.

Lower California to Peru; Galapagos Islands; Porto Rico.

MICROPHRYS ACULEATUS (Bell). See page 536.

Galapagos Islands; Ecuador; Peru.

MICROPHRYS BRANCHIALIS Rathbun.

Proc. U. S. Nat. Mus., vol. 21, 1898, p. 577, pl. 41, fig. 5. Lower California and Gulf of California; Galapagos Islands. On reef, and from 12 to 48 fathoms.

Genus MITHRAX Latreille.

MITHRAX ROSTRATUS Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 171; Trans. Zool. Soc. London, vol. 2, 1836, p. 51, pl. 10, fig. 1. West coast of South America (?).

MITHRAX BELLII Gerstaecker.

Arch. f. Naturg., vol. 22, pt. 1, 1856, p. 112.—*Mithrax ursus* BELL, Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 171; Trans. Zool. Soc. London, vol. 2, 1836, p. 52, pl. 10, figs. 2 and 3. Galapagos Islands; Chile.

MITHRAX PYGMÆUS Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 172; Trans. Zool. Soc. London, vol. 2, 1836, p. 55, pl. 11, fig. 3. Panama, 10 fathoms.

MITHRAX TRIGONOPUS Cano.

Mithrax trigonopus CANO, Boll. Soc. Nat. Napoli (1), vol. 3, 1889, p. 183, pl. 7, fig. 8. Panama.

MITHRAX TUMIDUS (Cano).

Mitraculus tumidus CANO, Boll. Soc. Nat. Napoli (1), vol. 3, 1889, p. 186, pl. 7, fig. 7. Payta, Peru.

MITHRAX NODOSUS Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 171; Trans. Zool. Soc. London, vol. 2, 1836, p. 53, pl. 11, fig. 1. Galapagos Islands; Chile.

MITHRAX DENTICULATUS Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 172; Trans. Zool. Soc. London, vol. 2, 1836, p. 54, pl. 11, fig. 2. Lower California to Ecuador; Galapagos Islands.

MITHRAX AREOLATUS Lockington.

Proc. Cal. Acad. Sci., vol. 7, 1876 (1877), p. 71 [9]. Gulf of California; Pearl Islands, Bay of Panama.

MITHRAX SPINIPES (Bell).

Pisa spinipes BELL, Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 171; Trans. Zool. Soc. London, vol. 2, 1836, p. 50, pl. 9, fig. 6. Gulf of California, 33 fathoms; Galapagos Islands, 16 fathoms; Sancta Elena, Ecuador, 6 fathoms.

Genus **TELEOPHRYS** Stimpson.**TELEOPHRYS CRISTULIPES** Stimpson. See page 536.

Cape St. Lucas, Lower California, to Peru; Galapagos Islands; Brazil.

Genus **THOË** Bell.**THOË EROSA** Bell.

Proc. Zool. Soc. London, vol. 3, 1835 (1836), p. 171; Trans. Zool. Soc. London, vol. 2, 1836, p. 48, pl. 9, fig. 4. Panama; Galapagos Islands; Ecuador.

THOË SULCATA Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 177.—A. MILNE EDWARDS, Crust. Rég. Mex., 1875, pl. 19, fig. 5; 1878, p. 121. Lower California to Panama Bay.

THOË PANAMENSIS Nobil.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 30. Panama; Ecuador.

Family PARTHENOPIDÆ.

Subfamily PARTHENOPINÆ.

Genus PARTHENOPE Weber.

PARTHENOPE (PARTHENOPE) HYPONCUS (Stimpson).

Lambrus hyponcus STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 100.—A. MILNE EDWARDS, Crust. Rég. Mex., 1878, p. 153, pl. 30, fig. 3. Mazatlan, Mexico; Panama.

Genus SOLENOLAMBRUS Stimpson.

SOLENOLAMBRUS ARCUATUS Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 101. Panama.

Genus HETEROCRYPTA Stimpson.

HETEROCRYPTA MACROBRACHIA Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 103.—A. MILNE EDWARDS, Crust. Rég. Mex., 1878, p. 167, pl. 29, fig. 3. Magdalena Bay, Lower California, 12 to 51 fathoms; Mexico; Panama.

Family EURYALIDÆ (=CORYSTIDÆ).

Genus BELLIA Milne Edwards.

BELLIA PICTA Milne Edwards.

Ann. Sci. Nat. (3), vol. 9, 1848, p. 192. Peru; Chile.

Genus CORYSTOIDES Milne Edwards and Lucas.

CORYSTOIDES CHILENSIS Milne Edwards and Lucas.

D'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 32; vol. 9, atlas, 1847, pl. 16, fig. 1. Valparaiso, Chile.

Genus GOMEZA Gray.

GOMEZA SERRATA Dana.

Crust. U. S. Expl. Exped., pt. 1, 1852, p. 305; atlas, 1855, pl. 18, fig. 7. Callao, Peru; Calbuco, Chile; Patagonia, 50 fathoms.

Genus PSEUDOCORYSTES Milne Edwards.

PSEUDOCORYSTES SICARIUS (Poeppig).

Corystes sicarius PÖEPPIG, Arch. f. Naturg., vol. 2, pt. 1, 1836, p. 139.—*Pseudocorystes armatus* MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 30; vol. 9, atlas, 1847, pl. 15, fig. 2. Mollendo, Peru; Chile; Straits of Magellan.

Family PORTUNIDÆ.

Subfamily LIOCARCININÆ.

Genus OVALIPES Rathbun.

OVALIPES BIPUSTULATUS (Milne Edwards).

Platyonichus bipustulatus MILNE EDWARDS, Hist. Nat. Crust., vol. 1, 1834, p. 437, pl. 17, figs. 7-10. Chile; Juan Fernandez; Patagonia; Argentina; also Japan, New Zealand, Cape of Good Hope, etc.

Subfamily PORTUNINÆ.

Genus CALLINECTES Stimpson.

CALLINECTES TOXOTES Ordway. See page 536.

Cape St. Lucas to Peru.

CALLINECTES ARCUATUS Ordway. See page 537.

Lower California to Peru.

Genus ARENÆUS Dana.

ARENÆUS MEXICANUS (Gerstaecker). See page 537

West coast of Mexico to Peru.

Genus PORTUNUS Weber.

PORTUNUS (PORTUNUS) ACUMINATUS (Stimpson). See page 538.

Panama to Peru.

PORTUNUS (PORTUNUS) XANTUSII (Stimpson).

Achelöus xantusii STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 222.—*Neptunus xantusii* A. MILNE EDWARDS, Crust. Rég. Mex., 1879, p. 213, pl. 38, fig. 1; pl. 39, fig. 4. Puget Sound; from San Pedro, California, to Chile.

PORTUNUS (PORTUNUS) PANAMENSIS (Stimpson).

Achelöus panamensis STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 112. From Gulf of California and Magdalena Bay, west coast of Lower California, to Panama.

PORTUNUS (PORTUNUS) TRANSVERSUS (Stimpson).

Achelöus transversus STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 111. Manzanillo, Mexico; Panama Bay, 7 fathoms.

PORTUNUS (ACHELOÛS) SPINIMANUS Latreille.

Portunus spinimanus LATREILLE, Nouv. Dict. Hist. Nat., vol. 28, 1819, p. 47. America; common on coasts of Brazil.—*Achelöus spinimanus* A. MILNE EDWARDS, Arch. Mus. Hist. Nat., Paris, vol. 10, 1861, p. 341, pl. 32. The figures probably represent the species, but the locality, Chile, is very likely erroneous. Chile (A. Milne Edwards); Virginia to Rio de Janeiro, Brazil.^a

^a *Achelöus smithii* Verrill, Trans. Conn. Acad. Arts and Sci., vol. 13, 1908, p. 386 et seq., text figs. 32, 33, is based on a comparison with the enlarged figure of a very young specimen of *A. spinimanus* A. Milne Edwards, Crust. Rég. Mex., 1879, pl. 39, fig. 2. This figure was copied by Professor Verrill and labeled "about $\frac{1}{4}$ nat. size."

PORTUNUS (ACHELOÛS) BREVIMANUS (Faxon).

Achelous brevimanus FAXON, Mem. Mus. Comp. Zool., vol. 18, 1895, p. 23. San Benedicto Island, Lower California, to Cocos Island, Central America; Galapagos Islands. To a depth of 66 fathoms.

PORTUNUS (ACHELOÛS) ANGUSTUS Rathbun.

Proc. U. S. Nat. Mus., vol. 21, 1898, p. 594, pl. 44, fig. 2. Galapagos Islands, on reef, and also from 12 to 20 fathoms.

PORTUNUS (ACHELOÛS) STANFORDI Rathbun.

Proc. Wash. Acad. Sci., vol. 4, 1902, p. 282, pl. 12, fig. 11. Galapagos Islands, on reef.

Subfamily THALAMITINÆ.

Genus CRONIUS Stimpson.

CRONIUS EDWARDSII (Lockington).

Amphitrite edwardsii LOCKINGTON, Proc. Cal. Acad. Sci., vol. 7, 1876 (1877), p. 43 [3]. Lower California to Ecuador.

Subfamily PODOPHTHALMINÆ.

Genus EUPHYLAX Stimpson.

EUPHYLAX DOVII Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 226, pl. 5, fig. 5. Mexico (?); west coast of Central America to Payta, Peru.

Family POTAMONIDÆ.

Subfamily POTAMONINÆ.

Genus POTAMON Savigny.

POTAMON (GEOHELPHUSA) CHILENSIS (Heller).

Thelphusa chilensis HELLER, Verh. k.-k. Zool. Bot. Ges. Wien, vol. 12, abth. 1, 1862, p. 520 [2].—*Geothelphusa chilensis* HELLER, Reise Novara, vol. 2, abth. 3, 1865, Crust., p. 33, pl. 3, fig. 4. Chile.

Subfamily PSEUDOTHELPHUSINÆ.

Genus PSEUDOTHELPHUSA Saussure.

PSEUDOTHELPHUSA MACROPA (Milne Edwards).

Boscia macropa MILNE EDWARDS, Ann. Sci. Nat. (3), Zool., vol. 20, 1853, p. 208 [174].—*Pseudothelphusa macropa* RATHBUN, Nouv. Arch. Mus. Hist. Nat., Paris, vol. 7, 1905, p. 276, pl. 13, fig. 1, text fig. 74. Fresh waters of Colombia and Bolivia.

PSEUDOTHELPHUSA LINDIGIANA Rathbun.

Bull. Mus. Hist. Nat. Paris, 1897, p. 59; Nouv. Arch. Mus. Hist. Nat., Paris, vol. 7, 1905, p. 277, text fig. 75. Fresh waters of Colombia and Ecuador.

PSEUDOTHELPHUSA PLANA Smith.

Trans. Conn. Acad. Arts and Sci., vol. 2, 1870, pp. 146, 147.—
RATHBUN, Nouv. Arch. Mus. Hist. Nat., Paris, vol. 7, 1905,
p. 278, text fig. 76. Payta, Peru.

PSEUDOTHELPHUSA ECUADORENSIS Rathbun.

Bull. Mus. Hist. Nat., Paris, 1897, p. 58; Nouv. Arch. Mus. Hist.
Nat., Paris, vol. 7, 1905, p. 279, pl. 13, fig. 8, text fig. 77.
Ecuador, fresh water.

PSEUDOTHELPHUSA ÆQUATORIALIS (Ortmann).

Potamocarcinus æquatorialis ORTMANN, Zool. Jahrb. Syst.,
vol. 10, 1897, p. 319, pl. 17, fig. 5. Ecuador; Peru: Rio
Ucayali.

PSEUDOTHELPHUSA CHILENSIS (Milne Edwards and Lucas).

Potamia chilensis MILNE EDWARDS and LUCAS, d'Orbigny's Voy.
Amér. Mér., vol. 6, pt. 1, 1843, p. 22; vol. 9, atlas, 1847,
pl. 10, fig. 1. Lima, Peru.

PSEUDOTHELPHUSA NOBILII Rathbun.

Proc. U. S. Nat. Mus., vol. 21, 1898, pp. 518, 535, 537, text fig. 8.
Ecuador, fresh water.

PSEUDOTHELPHUSA CONRADI Nobil.

Pseudotelphusa conradi NOBILI, Boll. Mus. Zool. Anat. comp.
R. Univ. Torino, vol. 12, 1897, no. 275, p. 3.—*Pseudo-*
thelphusa conradi RATHBUN, Nouv. Arch. Mus. Hist. Nat.,
Paris, vol. 7, 1905, p. 298, text fig. 90. Ecuador; Peru:
Cuterro and Tambillo.

PSEUDOTHELPHUSA CAPUTII Nobil.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, 1901,
no. 415, p. 38. Fresh waters of Ecuador.

PSEUDOTHELPHUSA DENTATA (Latreille).

Telphusa dentata LATREILLE, Ency. Méth., Hist. Nat., Ent., vol.
10, 1825, p. 564 (not synonymy).—*Pseudotelphusa dentata*
RATHBUN, Nouv. Arch. Mus. Hist. Nat., Paris, vol. 7, 1905,
p. 300, pl. 14, fig. 4, text fig. 93. Chile (?).

PSEUDOTHELPHUSA HENRICI Nobil.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 12, 1897,
no. 275, p. 1. Fresh waters of Ecuador.

PSEUDOTHELPHUSA PERUVIANA Rathbun.

Proc. U. S. Nat. Mus., vol. 21, 1898, pp. 527, 535, 537, text fig. 18.
Moyombamba, Peru.

PSEUDOTHELPHUSA REFLEXIFRONS (Ortmann).

Potamocarcinus reflexifrons ORTMANN, Zool. Jahrb. Syst., vol. 10,
1897, pp. 317, 321, pl. 17, fig. 6. Upper Amazon.

Subfamily TRICHODACTYLINÆ.

Genus TRICHODACTYLUS Latreille.

TRICHODACTYLUS (TRICHODACTYLUS) FLUVIATILIS (Latreille).

Trichodactylus fluvialis LATREILLE, Encyc. Méth., Hist. Nat., Ent., vol. 10, 1825, p. 705.—*Trichodactylus* (*Trichodactylus*) *fluvialis* RATHBUN, Nouv. Arch. Mus. Hist. Nat., Paris (4), vol. 8, 1906, p. 35, pl. 15, fig. 11, text fig. 106. Fresh waters of Chile, Brazil, and Guiana.

TRICHODACTYLUS (VALDIVIA) MARGARITIFRONS (Ortmann).

Dilocarcinus margaritifrons ORTMANN, Zool. Jahrb. Syst., vol. 7, 1893, p. 492, pl. 17, fig. 11. Rio Ucayali, Peru; British Guiana.

TRICHODACTYLUS (VALDIVIA) PARDALINUS (Gerstaecker).

Dilocarcinus pardalinus GERSTAECKER, Arch. f. Naturg., vol. 22, pt. 1, 1856, p. 148. Upper Amazon (?); Paraguay.

TRICHODACTYLUS (VALDIVIA) LATIDENS (A. Milne Edwards).

Sylviocarcinus latidens A. MILNE EDWARDS, Ann. Soc. Ent. France (4), vol. 9, 1869, p. 175.—*Trichodactylus* (*Valdivia*) *latidens* RATHBUN, Nouv. Arch. Mus. Hist. Nat., Paris (4), vol. 8, 1906, p. 49, pl. 17, fig. 4, text fig. 112. Upper Amazon.

TRICHODACTYLUS (VALDIVIA) PERUVIANUS (A. Milne Edwards).

Sylviocarcinus peruvianus A. MILNE EDWARDS, Ann. Soc. Ent. France (4), vol. 9, 1869, p. 174.—*Trichodactylus* (*Valdivia*) *peruvianus* RATHBUN, Nouv. Arch. Mus. Hist. Nat., Paris (4), vol. 8, 1906, p. 50, pl. 17, fig. 1. Guyallaga, Peru; upper Amazon, Brazil.

TRICHODACTYLUS (DILOCARCINUS) ORBICULARIS (Meuschen).

Cancer orbicularis MEUSCHEN, Index Zoophylacii Gronoviani, fasc. 3, 1781.—*Trichodactylus* (*Dilocarcinus*) *orbicularis* RATHBUN, Nouv. Arch. Mus. Hist. Nat., Paris (4), vol. 8, 1906, p. 58, pl. 18, figs. 3, 8, text fig. 119. Brazil; Paraguay; North Argentina; Bolivia (?).

TRICHODACTYLUS (DILOCARCINUS) PICTUS (Milne Edwards).

Dilocarcinus pictus MILNE EDWARDS, Ann. Sci. Nat. (3), Zool., vol. 20, 1853, p. 216 [182]; Arch. Mus. Hist. Nat., Paris, vol. 7, 1854, p. 181, pl. 14, figs. 2-2d. Amazon at Nauta, Peru; Colombia; Guiana; Brazil; Paraguay; Argentina.

TRICHODACTYLUS (DILOCARCINUS) EMARGINATUS (Milne Edwards).

Dilocarcinus emarginatus MILNE EDWARDS, Ann. Sci. Nat. (3), Zool., vol. 20, 1853, p. 216 [182]; Arch. Mus. Hist. Nat., Paris, vol. 7, 1854, p. 181, pl. 14, fig. 4. Rio Ucayali, Peru; Colombia.

Family ATELECYCLIDÆ.

Subfamily ATELECYCLINÆ.

Genus ATELECYCLUS Leach.

ATELECYCLUS CHILENSIS Milne Edwards.

Hist. Nat. Crust., vol. 2, 1837, p. 143. Chile.

Genus HYPOPELTARIUM Miers.

HYPOPELTARIUM SPINULOSUM (White).

Atelecyclus spinulosus WHITE, Ann. Mag. Nat. Hist., vol. 12, 1843, p. 345.—*Peltarion spinulosum* DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 304; atlas, 1855, pl. 18, fig. 6a-b. Chile to Southern Patagonia; Falkland Islands.

Subfamily ACANTHOCYCLINÆ.

Genus ACANTHOCYCLUS Milne Edwards and Lucas.

ACANTHOCYCLUS GAYI Milne Edwards and Lucas.

D'Orbigny's Voy. Amér. Mér., vol. 6, 1843, pt. 1, p. 30; vol. 9, atlas, 1847, pl. 15, fig. 1. Peru to Straits of Magellan.

ACANTHOCYCLUS ALBATROSSIS Rathbun.

Proc. U. S. Nat. Mus., vol. 21, 1898, pp. 598, 599. Chile; west coast of Patagonia; Straits of Magellan (?).

ACANTHOCYCLUS HASSLERI Rathbun.

Proc. U. S. Nat. Mus., vol. 21, 1898, pp. 598, 599, pl. 43, fig. 1. Panama; Chile.

Family CANCRIDÆ.

Subfamily CANCRINÆ.

Genus CANCER Linnæus.

CANCER LONGIPES Bell.

Proc. Zool. Soc. London, vol. 3, 1835, p. 87; Trans. Zool. Soc. London, vol. 1, 1835, p. 337, pl. 43. Bay of Panama, 210 and 286 fathoms; Callao Reef, Peru; Bolivia; Chile.

CANCER EDWARDSII Bell.

Proc. Zool. Soc. London, vol. 3, 1835, p. 87.—*Cancer edwardsii* BELL, Trans. Zool. Soc. London, vol. 1, 1835, p. 338, pl. 44. Peru; Chile (as far as Chiloë).

CANCER POLYODON Pöppig. See page 538.

Ecuador; Peru; Chile.

CANCER PLEBEJUS Pöppig. See page 539.

Peru to Port Otway, Patagonia.

Family XANTHIDÆ.

Subfamily XANTHINÆ.

Genus PLATYXANTHUS A. Milne Edwards.

PLATYXANTHUS ORBIGNYI (Milne Edwards and Lucas). See page 539.

Ecuador; Peru; Chile.

PLATYXANTHUS CRENULATUS A. Milne Edwards. See page 540.

Peru to Patagonia.

Genus XANTHO Leach.

XANTHO GAUDICHAUDII Milne Edwards. See page 540.

Ecuador to Patagonia; Juan Fernandez.

XANTHO CRENATUS Milne Edwards.

Hist. Nat. Crust., vol. 1, 1834, p. 396. Peru (Milne Edwards); Payta (Cano).

Genus LEPTODIUS A. Milne Edwards.

LEPTODIUS OCCIDENTALIS (Stimpson).

Chlorodius occidentalis STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 108. Lower California to Panama; Galapagos Islands.

LEPTODIUS COOKSONI Miers.

Proc. Zool. Soc. London, 1877, p. 73, pl. 12, figs. 1-1d. Galapagos Islands.

LEPTODIUS SNODGRASSI Rathbun.

Proc. Wash. Acad. Sci., vol. 4, 1902, p. 279, pl. 13, figs. 7 and 8. Galapagos Islands.

LEPTODIUS SPINOSO-GRANULATUS Lenz.

Zool. Jahrb., Suppl. vol. 5, 1902, p. 762, pl. 23, figs. 8, 8a. Juan Fernandez.

LEPTODIUS TRIDENTATUS Lenz.

Zool. Jahrb., Suppl. vol. 5, 1902, p. 761, pl. 23, figs. 7, 7a. Puerto Corral, Chile; Juan Fernandez.

Genus XANTHODIUS Stimpson.

XANTHODIUS STERNBERGHII Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 52. Lower California to Ecuador.

XANTHODIUS LOBATUS (A. Milne Edwards).

Leptodius lobatus A. MILNE EDWARDS, Crust. Rég. Mex., 1880, p. 271, pl. 49, fig. 4. Clarion Island, Mexico; Galapagos Islands; Chile.

Genus HOMALASPIS A. Milne Edwards.

HOMALASPIS PLANA (Milne Edwards).

Xantho planus MILNE EDWARDS, Hist. Nat. Crust., vol. 1, 1834, p. 397. From Callao, Peru, to Straits of Magellan.

Genus PARAXANTHUS Milne Edwards and Lucas.

PARAXANTHUS BARBIGER (Poeppig).

Gecarcinus barbiger PÖEPPIG, Arch. f. Naturg., vol. 2, pt. 1, 1836, p. 138.—*Paraxanthus hirtipes* MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, pt. 1, 1843, p. 19; vol. 9, atlas, pl. 7bis, fig. 1. Callao, Peru; Chile; Juan Fernandez.

Genus CYCLOXANTHOPS Rathbun.

CYCLOXANTHOPS SEXDECIMIDENTATUS (Milne Edwards and Lucas). See page 541.
Ecuador; Peru; Chile.

CYCLOXANTHOPS VITTATUS (Stimpson).

Xantho vittata STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 206. Cape St. Lucas, Lower California; Panama.

CYCLOXANTHOPS (?) STIMPSONI (A. Milne Edwards).

Xantho stimpsoni A. MILNE EDWARDS, Crust. Rég. Mex., 1879, p. 252, pl. 46, fig. 2. Cape St. Lucas and Mazatlan, Mexico; Ecuador.

Genus MEDÆUS Dana.

MEDÆUS LOBIPES Rathbun.

Proc. U. S. Nat. Mus., vol. 21, 1898, p. 583, pl. 44, fig. 1. Cape St. Lucas; Panama Bay; Galapagos Islands. 5½ to 33 fathoms.

Subfamily ACTÆINÆ.

Genus ACTÆA de Haan.

ACTÆA DOVII Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 104.—A. MILNE EDWARDS, Crust. Rég. Mex., 1879, p. 244, pl. 45, fig. 1. Salvador; Panama; Ecuador; Galapagos Islands.

Genus GLYPTOXANTHUS A. Milne Edwards.

GLYPTOXANTHUS LABYRINTHICUS (Stimpson).

Actæa labyrinthica STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 204.—*Glyptoxanthus labyrinthicus* A. MILNE EDWARDS, Crust. Rég. Mex., 1879, p. 255, pl. 43, fig. 4. West coast of Mexico; Panama.

Genus DAIRA de Haan.

DAIRA AMERICANA Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 212.—A. MILNE EDWARDS, Nouv. Arch. Mus. Hist. Nat., Paris, vol. 1, 1866, p. 299, pl. 16, figs. 4–4c. California (A. Milne Edwards) to Ecuador. By "California" was probably meant "Lower California."

Genus PLATYPODIA Bell.

PLATYPODIA ROTUNDATA (Stimpson).

Atergatis rotundatus STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 202.—*Lophactæa rotundata* A. MILNE EDWARDS, Crust. Rég. Mex., 1879, p. 243; 1880, pl. 44, fig. 2. Cape St. Lucas, Lower California; Panama.

PLATYPODIA GEMMATA Rathbun.

Proc. Wash. Acad. Sci., vol. 4, 1902, p. 279, pl. 12, figs. 5 and 6. Galapagos Islands.

Subfamily CHLORODIEILINÆ.

Genus MICROPANOPE Stimpson.

MICROPANOPE TABOGUILLENSIS Rathbun.

Mem. Mus. Comp. Zoöl., vol. 35, 1907, p. 69, pl. 1, fig. 8; pl. 7, figs. 3 and 3a. Taboguilla Island, Panama.

Genus XANTHIAS Rathbun.

XANTHIAS XANTUSII (Stimpson).

Xanthodes xantusii STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 105. Cape St. Lucas; Ecuador.

Subfamily PANOPEINÆ.

Genus PANOPEUS Milne Edwards.

PANOPEUS PURPUREUS Lockington. See page 541.

Lower California to Peru.

PANOPEUS CHILENSIS Milne Edwards and Lucas. See page 542.

West coast of Mexico to Chile.

PANOPEUS BERMUDENSIS Benedict and Rathbun. See page 542.

Peru; Florida to Brazil; Bermudas.

PANOPEUS BRADLEYI Smith.

Proc. Boston Soc. Nat. Hist., vol. 12, 1869, p. 281. Panama.

Genus EURYPANOPEUS A. Milne Edwards.

EURYPANOPEUS TRANSVERSUS (Stimpson). See page 543.

Salvador to Peru.

EURYPANOPEUS PLANUS (Smith).

Panopeus planus SMITH, Proc. Boston Soc. Nat. Hist., vol. 12, 1869, p. 283.—BENEDICT and RATHBUN, Proc. U. S. Nat. Mus., vol. 14, 1891, p. 369, pl. 24, figs. 10 and 11. Panama; Ecuador.

EURYPANOPEUS CRENATUS (Milne Edwards and Lucas).

Panopeus crenatus MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, pt. 1, 1843, p. 16; vol. 9, atlas, 1847, pl. 8, fig. 1. Puna, Ecuador; Callao, Peru; Chile.

Genus EURYTIIUM Stimpson.

EURYTIIUM AFFINE (Streets and Kingsley).

Panopeus affinis STREETS and KINGSLEY, Bull. Essex Inst., vol. 9, 1877, p. 106.—*Eurytium affine* A. MILNE EDWARDS, Crust. Rég. Mex., 1880, p. 334, pl. 60, fig. 1. Lower California; Ecuador (?).

EURYTIIUM TRISTANI Rathbun. See page 543.

Costa Rica; Peru.

Subfamily MENIPPINÆ.

Genus MENIPPE de Haan.

MENIPPE OBTUSA Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 53; Crust. Rég. Mex., 1879, p. 264, pl. 48, fig. 1. Panama.

MENIPPE FRONTALIS A. Milne Edwards.

Crust. Rég. Mex., 1879, p. 264, pl. 48, fig. 2. Nicaragua; Panama; Ecuador.

Genus PILUMNOIDES Milne Edwards and Lucas.

PILUMNOIDES PERLATUS (Poeppig). See page 544.

Panama to Chile.

PILUMNOIDES PUSILLUS Rathbun.

Proc. Wash. Acad. Sci., vol. 4, 1902, p. 281, pl. 12, figs. 9 and 10, Galapagos Islands.

Subfamily PILUMNINÆ.

Genus PILUMNUS Leach.

PILUMNUS LIMOSUS Smith.

Proc. Boston Soc. Nat. Hist., vol. 12, 1869, p. 285.—A. MILNE EDWARDS, Crust. Rég. Mex., 1880, p. 291, pl. 50, fig. 4. Panama; Ecuador; Peru at Zorritos.

PILUMNUS SPINOHIRSUTUS (Lockington).

Acanthus spino-hirsutus LOCKINGTON, Proc. Cal. Acad. Sci., vol. 7, 1876 (1877), pp. 33, 102. San Diego, California; Gulf of California; Ecuador.

PILUMNUS SPINULIFER Rathbun.

Proc. U. S. Nat. Mus., vol. 21, 1898, p. 585, pl. 42, figs. 6–8. Off Cape St. Lucas, 31 fathoms; Galapagos Islands, on reef, also at 12 fathoms.

Genus HETERACTÆA Lockington.

HETERACTÆA LUNATA (Milne Edwards and Lucas).

Pilumnus lunatus MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, 1843, p. 20; vol. 9, atlas, 1847, pl. 9, fig. 2. From San Diego, California, to Chile.

Subfamily OZIINÆ.

Genus OZIUS Milne Edwards.

OZIUS VERREAUXII Saussure.

Rev. et Mag. de Zool. (2), vol. 5, 1853, p. 359, pl. 12, fig. 1.
Lower California to Ecuador; Galapagos Islands.

OZIUS AGASSIZII A. Milne Edwards.

Crust. Rég. Mex., 1880, p. 279, pl. 55, fig. 1. Gulf of Panama to
Ecuador; Galapagos Islands.

Subfamily ERIPHIINÆ.

Genus ERIPHIA Latreille.

ERIPHIA SQUAMATA Stimpson. See page 544.

Lower California to Chile.

ERIPHIA GRANULOSA A. Milne Edwards.

Crust. Rég. Mex., 1880, p. 339, pl. 56, fig. 2. Galapagos Islands;
Chile.

Genus ERIPHIDES Rathbun.

ERIPHIDES HISPIDA (Stimpson).

Eriphia hispida STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7,
1860, p. 218.—*Pseuderiphia hispida* A. MILNE EDWARDS,
Crust. Rég. Mex., 1880, p. 340, pl. 56, fig. 1. West coast of
Central America; Panama; Galapagos Islands.

Subfamily TRAPEZIINÆ.

Genus TRAPEZIA Latreille.

TRAPEZIA CYMODOCE FERRUGINEA Latreille.

Trapezia ferruginea LATREILLE, Encyc. Méth., Ent., vol. 10,
1825, p. 695.—*Trapezia cymodoce* DANA, Crust. U. S. Expl.
Exped., pt. 1, 1852, p. 257; atlas, 1855, pl. 15, fig. 5.
Acapulco, Mexico (Faxon); Pearl Islands, Bay of Panama
(A. Milne Edwards, Smith, Faxon); Indo-Pacific region.

TRAPEZIA DIGITALIS Latreille.

Encyc. Méth., Ent., vol. 10, 1825, p. 696.—*Trapezia formosa*
A. MILNE EDWARDS, Crust. Rég. Mex., 1880, p. 343, pl. 58,
fig. 1. Cape St. Lucas, Mexico, to Panama Bay; Indo-
Pacific region.

Genus QUADRELLA Dana.

QUADRELLA CORONATA Dana.

Crust. U. S. Expl. Exped., pt. 1, 1852, p. 266; atlas, 1855, pl.
16, fig. 5. Pearl Islands, Panama Bay, 6 to 8 fathoms;
Indo-Pacific region.

Family GONOPLACIDÆ.

Subfamily PRIONOPLACINÆ.

Genus PRIONOPLAX Milne Edwards.

PRIONOPLAX CILIATA Smith.

Prionoplax ciliatus SMITH, Trans. Conn. Acad. Sci., vol. 2, 1870, p. 160. Panama; Guayaquil, Ecuador.

Genus EURYPLAX Stimpson.

EURYPLAX POLITA Smith.

Euryplax politus SMITH, Trans. Conn. Acad. Sci., vol. 2, 1870, p. 163. Panama.

Genus SPOECARCINUS Stimpson.

SPOECARCINUS OSTREARICOLA Rathbun. See page 545.

Matapalo, Peru.

Genus GLYPTOPLAX Smith.

GLYPTOPLAX PUGNAX Smith.

Trans. Conn. Acad. Sci., vol. 2, 1870, p. 165.—A. MILNE EDWARDS, Crust. Rég. Mex., 1880, p. 335, pl. 61, figs. 5-5f. Costa Rica to Panama.

Family PINNOTHERIDÆ.

Subfamily PINNOTHERINÆ.

Genus PINNOTHERES Latreille.

PINNOTHERES MARGARITA Smith.

In Verrill, Amer. Nat., vol. 3, 1869, p. 245; Trans. Conn. Acad. Sci., vol. 2, 1870, p. 166. La Paz, Lower California; Pearl Islands, Bay of Panama. In pearl oyster.

PINNOTHERES SILVESTRII Nobili.

Pinnotheres silvestrii NOBILI, Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 402, 1901, p. 11; Revista Chilena Hist. Nat., vol. 6, 1902, p. 235. San Vicente, Chile.

PINNOTHERES BIPUNCTATUM Nicolet.

In Gay, Hist. Chile, Zool., vol. 3, 1849, p. 155, pl. 1, fig. 2. San Carlos de Chiloë.

Genus PINNAXODES Heller.

PINNAXODES CHILENSIS (Milne Edwards).

Pinnotheres chilensis MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 33. Ecuador to Port Otway, Patagonia.

PINNAXODES MEINERTI Rathbun.

Proc. Biol. Soc. Wash., vol. 17, 1904, p. 162. Valparaiso, Chile.

Genus OSTRACOTHERES Milne Edwards.

OSTRACOTHERES POLITUS Smith. See page 545.

Peru; Chile.

Genus DISSODACTYLUS Smith.

DISSODACTYLUS NITIDUS Smith. See page 545.

Off Abrejos Point, Lower California, to Peru.

Subfamily PINNOTHERELINÆ.

Genus PINNIXA White.

PINNIXA TRANSVERSALIS (Milne Edwards and Lucas). See page 546.

Panama to Punta Arenas, Patagonia.

PINNIXA VALDIVIENSIS Rathbun.

Revista Chilena Hist. Nat., vol. 11, 1907, p. 45, pl. 3, figs. 2, 3,
text fig. 1. Corral, Province Valdivia, Chile.

Genus PINNOTHERELIA Milne Edwards and Lucas.

PINNOTHERELIA LÆVIGATA Milne Edwards and Lucas. See page 546.

Peru; Chile.

Family GRAPSIDÆ.

Subfamily GRAPSINÆ.

Genus GRAPSUS Lamarck.

GRAPSUS GRAPSUS (Linnaeus). See page 547.

Lower California to Chile; Galapagos Islands; Juan Fernandez
Also shores of tropical Atlantic.

GRAPSUS STRIGOSUS (Herbst).

Cancer strigosus HERBST, Naturg. d. Krabben u. Krebse, vol. 3,
pt. 1, 1799, p. 55, pl. 47, fig. 7.—*Grapsus strigosus* DANA,
Crust. U. S. Expl. Exped., pt. 1, 1852, p. 338; atlas, 1855,
pl. 21, fig. 2. Chile; Indo-Pacific region.

Genus GEOGRAPSUS Stimpson.

GEOGRAPSUS LIVIDUS (Milne Edwards).

Grapsus lividus MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837,
p. 85.—DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p.
340; atlas, 1855, pl. 21, fig. 5a-c. Lower California to
Chile; Clipperton Island; Galapagos Islands; Florida
Keys to Colombia.

Genus LEPTOGRAPSUS Milne Edwards.

LEPTOGRAPSUS VARIEGATUS (Fabricius). See page 547.

Peru; Chile; Juan Fernandez; also Australia and other parts
of the southern hemisphere.

Genus GONIOPSIS de Haan.

GONIOPSIS PULCHRA (Lockington). See page 547.

From Magdalena Bay, Lower California, to Peru.

Genus PACHYGRAPSUS Randall.

PACHYGRAPSUS CRASSIPES Randall.

Jour. Acad. Nat. Sci. Phila., vol. 8, 1839 (1840), p. 127.—DE MAN, Notes Leyden Mus., vol. 12, 1890, p. 86, pl. 5, fig. 11. Oregon to Gulf of California; Galapagos Islands; Chile. Japan.

PACHYGRAPSUS, sp. [near CRASSIPES], Nobili.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 42. Tumaco, Colombia.

PACHYGRAPSUS TRANSVERSUS (Gibbes). See page 548.

California to Peru; Galapagos Islands. Also widely distributed in tropical Atlantic and Oriental region.

PACHYGRAPSUS PUBESCENS Heller.

Reise Novara, Crust., 1865, p. 45, pl. 4, fig. 4. Chile.

Genus PLANES Bowdich.

PLANES MINUTUS (Linnaeus).

Cancer minutus LINNÆUS, Syst. Nat., 10th ed., vol. 1, 1758, p. 625. From Alaska to Bay of Valparaiso, Chile; off Galapagos Islands. In all tropical and temperate seas.

Subfamily VARUNINÆ.

Genus CYRTOGRAPSUS Dana.

CYRTOGRAPSUS ANGULATUS Dana.

Proc. Acad. Nat. Sci. Phila., vol. 5, 1851, p. 250; Crust. U. S. Expl. Exped., pt. 1, 1852, p. 352; atlas, 1855, pl. 22, fig. 6a-e. San Lorenzo Island, Peru; Rio de Janeiro, Brazil, to Rio Negro, Patagonia.

Genus HEMIGRAPsus Dana.

HEMIGRAPsus CRENUlATUS (Milne Edwards).

Cyclograpsus crenulatus MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 80.—*Hemigrapsus crenulatus* DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 349; atlas, 1855, pl. 22, fig. 3. Chile; west coast of Patagonia; New Zealand.

Genus GLYPTOGRAPSUS Smith.

GLYPTOGRAPSUS IMPRESSUS Smith.

Trans. Conn. Acad. Sci., vol. 2, 1870, p. 154. Acapulco, Mexico, to Panama.

Subfamily SESARMINÆ.

Genus SESARMA Say.

SESARMA (SESARMA) ÆQUATORIALIS Ortmann.

Sesarma æquatorialis ORTMANN, Zool. Jahrb. Syst., vol. 7, 1894, p. 722, pl. 23, figs. 14, 14k, 14z. Ecuador.

SESARMA (SESARMA) BARBIMANUM Cano.

Sesarma barbimana CANO, Boll. Soc. Nat. Napoli (1), vol. 3, 1889, pp. 93, 245. Payta, Peru.

SESARMA (SESARMA) OPHIODERMA Nobil.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 44. Ecuador.

SESARMA (HOLOMETOPUS) OCCIDENTALE Smith.

Sesarma occidentalis SMITH, Trans. Conn. Acad. Sci., vol. 2, 1870, p. 158. Acajutla, Salvador; Ecuador.

SESARMA (HOLOMETOPUS) ANGUSTUM Smith.

Sesarma angusta SMITH, Trans. Conn. Acad. Sci., vol. 2, 1870, p. 159. Costa Rica to Bay of Panama.

SESARMA (HOLOMETOPUS) FESTÆ Nobil.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 42. Ecuador.

Genus ARATUS Milne Edwards.

ARATUS PISONI (Milne Edwards). See page 548.

Nicaragua to Peru; east coast of America.

Genus CYCLOGRAPSPUS Milne Edwards.

CYCLOGRAPSPUS CINEREUS Dana.

Proc. Acad. Nat. Sci. Phila., 1851, p. 251; Crust. U. S. Expl. Exped., pt. 1, 1852, p. 360; atlas, 1855, pl. 23, fig. 3a-e. Panama to Lota, Chile.

CYCLOGRAPSPUS PUNCTATUS Milne Edwards.

Hist. Nat. Crust., vol. 2, 1837, p. 78.—*Gnathochasmus barbatus* McLEAY, Ill. Zool. S. Africa, 1838, p. 65, pl. 3. Chile; Juan Fernandez; South Africa; Indian Ocean.

Subfamily PLAGUSIINÆ.

Genus PLAGUSIA Latreille.

PLAGUSIA TUBERCULATA Lamarck.

Hist. Nat. Anim. sans Vert., vol. 5, 1818, p. 247.—*Plagusia immaculata* MIERS, *Challenger* Brachyura, 1886, p. 273, pl. 22, fig. 1. Lower California to Chile; Indo-Pacific region.

PLAGUSIA CHABRUS (Linnaeus).

Cancer chabrus LINNÆUS, Mus. Lud. Ulr., 1764, p. 438.—
Plagusia tomentosa KRAUSS, Südafr. Crust., 1843, p. 42, pl.
 2, fig. 6. Chile; Juan Fernandez; Tongatabu; Australia;
 Tasmania; New Zealand; Cape of Good Hope.

Genus PERCNON Gistel.

PERCNON PLANISSIMUM (Herbst).

Cancer planissimus HERBST, Natur. d. Krabben u. Krebse, vol.
 3, pt. 4, 1804, p. 3, pl. 59, fig. 3. Cape St. Lucas to Chile;
 Bahamas to Brazil; Bermudas; eastern Atlantic to Japan
 and Hawaiian Islands.

Family GECARCINIDÆ.

Genus CARDISOMA Latreille.

CARDISOMA CRASSUM Smith. See page 549.

La Paz, Mexico, to Peru.

Genus UCIDES Rathbun.

UCIDES OCCIDENTALIS (Ortmann). See page 549.

Lower California to Peru; Valparaiso, Chile (?).

Genus GECARCINUS Leach.

GECARCINUS LATERALIS (Fremenville).

Ocypoda lateralis FREMINVILLE, Ann. Sci. Nat. (2), Zool., vol. 3,
 1835, p. 224.—*Gecarcinus lateralis* GUÉRIN, Icon. Règne
 Anim., pl. 5, fig. 1. Ecuador (Cano, Nobili); Bahamas to
 Guiana; Bermudas.

GECARCINUS QUADRATUS Sausseure.

Rev. et Mag. de Zool. (2), vol. 5, 1853, p. 360, pl. 12, fig. 2.
 Mexico to Panama; Turbo, Colombia (Atlantic side).

GECARCINUS MALPILENSIS Faxon.

Bull. Mus. Comp. Zoöl., vol. 24, 1893, p. 157; Mem. Mus. Comp.
 Zoöl., vol. 18, 1895, p. 28, pl. 4, figs. 2-2b. Malpelo Island,
 off Bay of Panama.

Family OCYPODIDÆ.

Subfamily OCYPODINÆ.

Genus OCYPODE Fabricius.

OCYPODE OCCIDENTALIS Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 229. Lower Cali-
 fornia to Peru.

OCYPODE GAUDICHAUDII Milne Edwards and Lucas. See page 550.

Lower California to Chile; Galapagos Islands.

Genus UCA Leach.

UCA PRINCEPS (Smith). See page 550.

San Bartolome Bay, Lower California, to Peru.

UCA STYLIFERA (Milne Edwards).

Gelasimus platydactylus MILNE EDWARDS, Règne Anim. Cuvier, disciples ed., Crust., pl. 18, fig. 1a (not MILNE EDWARDS, 1837).—*Gelasimus styliferus* MILNE EDWARDS, Ann. Sci. Nat. (3), Zool., vol. 18, 1852, p. 145 [109], pl. 3, fig. 3. Salvador to Guayaquil, Ecuador.

UCA INSIGNIS (Milne Edwards). See page 551.

Salvador to Chile.

UCA BREVIFRONS (Stimpson).

Gelasimus brevifrons STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1860, p. 229.—*Uca brevifrons* HOLMES, Proc. Cal. Acad. Sci. (3), vol. 3, 1904, p. 308, pl. 35, figs. 1-5. Lower California to Panama.

UCA GALAPAGENSIS Rathbun. See page 551.

Galapagos Islands; Peru.

UCA MACRODACTYLUS (Milne Edwards and Lucas).

Gelasimus macrodactylus MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, 1843, p. 27; vol. 9, atlas, 1847, pl. 11, fig. 3. Guaymas, Mexico, to Valparaiso, Chile.

UCA PANAMENSIS (Stimpson).

Gelasimus panamensis STIMPSON, Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 63.—SMITH, Trans. Conn. Acad. Sci., vol. 2, 1870, p. 139, pl. 4, fig. 5. Gulf of Fonseca, Central America, to Payta, Peru.

UCA HELLERI Rathbun.

Proc. Wash. Acad. Sci., vol. 4, 1902, p. 277, pl. 12, figs. 3 and 4. Galapagos Islands.

UCA STENODACTYLUS (Milne Edwards and Lucas).

Gelasimus stenodactylus MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, 1843, p. 26; vol. 9, atlas, 1847, pl. 11, fig. 2. Gulf of Fonseca, Salvador, to Valparaiso, Chile.

UCA FESTÆ Nobill.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 51. Ecuador.

UCA LATIMANUS (Rathbun).

Gelasimus latimanus RATHBUN, Proc. U. S. Nat. Mus., vol. 16, 1893, p. 245. La Paz, Mexico, to Ecuador.

Subfamily MACROPHTHALMINÆ.

Genus EUPLAX Milne Edwards.

EUPLAX LEPTOPHTHALMA Milne Edwards.

Ann. Sci. Nat. (3), Zool., vol. 18, 1852, p. 160 [124]. Chile.

Tribe OXYSTOMATA.

Family CALAPPIDÆ.

Subfamily CALAPPINÆ.

Genus CALAPPA Fabricius.

CALAPPA CONVEXA Saussure.

Rev. et Mag. de Zool. (2), vol. 4, 1853, p. 362, pl. 13, fig. 3.
Cape St. Lucas, Lower California, to Ecuador.

Genus PLATYMERIA Milne Edwards.

PLATYMERIA GAUDICHAUDII Milne Edwards.

Platymera gaudichaudii MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 108.—MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. Mér., vol. 6, 1843, p. 28; vol. 9, atlas, pl. 13, fig. 1. Coast of California, 26 to 218 fathoms, to Chile.

Subfamily MATUTINÆ.

Genus HEPATUS Latreille.

HEPATUS KOSSMANNI Neumann.

Catalog Pod. Crust. Heidelberger Mus., 1878, p. 28. Panama Bay, 7 to 14 fathoms; Callao (Cano); North Island, Chinchas (Kinahan); Chile (Lenz).

HEPATUS CHILIENSIS Milne Edwards. See page 551.

Ecuador; Peru; Chile.

Genus HEPATELLA Smith.

HEPATELLA AMICA Smith. See page 552.

Panama; Peru.

Genus OSACHILA Stimpson.

OSACHILA ACUTA Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 114. Manzanillo, Mexico, to Panama; Darien (Nobili).

Family LEUCOSIIDÆ.

Subfamily LEUCOSIINÆ.

Genus UHLIAS Stimpson.

UHLIAS ELLIPTICUS Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 10, 1871, p. 117. Panama; Ecuador.

Genus LEUCOSILIA Bell.

LEUCOSILIA JURINEI (Saussure). See page 552.

Mazatlan, Mexico, to Peru; Galapagos Islands.

Genus PERSEPHONA Leach.

PERSEPHONA EDWARDSII Bell.

Trans. Linn. Soc. London, vol. 21, 1855, p. 294, pl. 31, fig. 8.
Panama; Galapagos Islands.

PERSEPHONA ORBICULARIS Bell.

Trans. Linn. Soc. London, vol. 21, 1855, p. 294, pl. 31, fig. 7.
Valparaiso, Chile.

PERSEPHONA TOWNSENDI (Rathbun).

Myra townsendi RATHBUN, Proc. U. S. Nat. Mus., vol. 16, 1893,
p. 255. Gulf of California, 20 to 58 fathoms; Panama Bay,
7 to 14 fathoms.

Tribe DROMIACEA.

Family HOMOLIDÆ.

Genus PAROMOLA Wood-Mason.

PAROMOLA RATHBUNI Porter.

Revista Chilena Hist. Nat., vol. 12, 1908, p. 88, pl. 8. Juan
Fernandez.

Family DROMIIDÆ.

Genus DROMIDIA Stimpson.

DROMIDIA SARRABUREI Rathbun. See page 553.

Bay of Sechura, Peru.

Genus HYPOCONCHA Guérin.

HYPOCONCHA PANAMENSIS Smith.

Amer. Nat., vol. 3, 1869, p. 249. Bay of Realejo, Nicaragua;
Panama.

HYPOCONCHA PERUVIANA Rathbun. See page 553.

Matapalo, near Capon, Peru.

Tribe HIPPIDEA.

Family ALBUNEIDÆ.

Genus BLEPHARIPODA Randall.

BLEPHARIPODA OCCIDENTALIS Randall.

Jour. Acad. Nat. Sci. Phila., vol. 8, 1839 (1840), p. 131, pl. 6.
San Francisco, California, to Chile.

Genus LEPIDOPA Stimpson.

LEPIDOPA CHILENSIS Lenz.

Zool. Jahrb., Suppl. vol. 5, 1902, p. 749, pl. 23, figs. 5, 5a. San Lorenzo, Peru (?); Iquique, Chile.

Genus ALBUNEA Fabricius.

ALBUNEA, sp., Cunningham.

Trans. Linn. Soc. London, vol. 27, 1871, p. 494. Herradura Bay, Chile.

Family HIPPIDÆ.

Genus EMERITA Gronovius.

EMERITA ANALOGA (Stimpson). See page 554.

Oregon to Chile.

EMERITA EMERITA (Linnaeus). See page 554.

Lower California to Chile; Florida to Brazil.

Genus HIPPA Fabricius.

HIPPA DENTICULATIFRONS (Miers).

Remipes testudinarius, var. *denticulatifrons* MIERS, Jour. Linn. Soc. London, vol. 14, 1878, p. 318, pl. 5, fig. 2. Galapagos Islands; Indo-Pacific region.

Tribe PAGURIDEA.

Family LITHODIDÆ.

Genus LITHODES Latreille.

LITHODES ANTARCTICA Jacquinot.

In Hombron and Jacquinot, Voy. au Pôle Sud, Zool., vol. 3, 1852 (?), Crust., p. 90; atlas of zool., pl. 7, fig. 1, pl. 8, figs. 9–14. Calbuco, Chile, to Terra del Fuego.

Family CÆNOBITIDÆ.

Genus CÆNOBITA Latreille.

CÆNOBITA RUGOSUS Milne Edwards.

Cenobita rugosa MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 241.—*Cænobita rugosus* ALCOCK, Cat. Indian Dec. Crust., pt. 2, fasc. 1, 1905, p. 143, pl. 14, figs. 3, 3a. Lower California to Chile; Vancouver Island (?); Indo-Pacific to tropical West Africa.

CÆNOBITA RUGOSUS WAGNERI Doflein.

Cænobita rugosus, var. *wagneri* DOFLEIN, Sitzungsber. math.-phys. Cl. Akad. Wiss. München, 1900, p. 134. Rio Bayano, Panama.

CÆNOBITA COMPRESSUS Guérin.

Cænobita compressa GUÉRIN, Voy. autour du Monde sur la Coquille par Duperrey, Zool., vol. 2, pt. 2, 1831, p. 29. Lower California to Payta, Peru; Galapagos Islands; westward to East Africa.

CÆNOBITA PANAMENSIS Streets.

Cenobita panamensis STREETS, Proc. Acad. Nat. Sci. Phila., 1871, p. 241. Lower California; Panama.

Family PAGURIDÆ.

Subfamily DARDANINÆ.

Genus PAGURISTES Dana.

PAGURISTES WEDDELLII (Milne Edwards).

Pagurus weddellii MILNE EDWARDS, Ann. Sci. Nat., Zool. (3), vol. 10, 1848, p. 64. Peru.

PAGURISTES HIRTUS Dana. See page 555.

Peru; Chile.

PAGURISTES TOMENTOSUS (Milne Edwards). See page 555.

Peru; Chile (?).

Genus CLIBANARIUS Dana.

CLIBANARIUS ÆQUABILIS Dana.

Crust. U. S. Expl. Exped., pt. 1, 1852, p. 464; atlas, 1855, pl. 29, fig. 4a-f. Chile; California; and westward to Madeira.

CLIBANARIUS PANAMENSIS Stimpson. See page 555.

Lower California to Peru.

CLIBANARIUS ALBIDIGITUS Nobil.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 24. Ecuador.

Genus ISOICHELES Stimpson.

ISOICHELES ÆQUIMANUS (Dana).

Bernhardus æquimanus DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 445; atlas, 1855, pl. 27, fig. 6. Valparaiso (?), Chile.

ISOICHELES WURDEMANNI PACIFICUS Bouvier.

Isocheles wurdemanni, var. *pacificus* BOUVIER, Bull. Mus. Hist. Nat., Paris, 1907, no. 2, p. 115, text figs. 2, 3. Payta, Peru.

Genus CALCINUS Dana.

CALCINUS OBSCURUS Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 83. Lower California to Ecuador.

CALCINUS CHILENSIS (Milne Edwards).

Pagurus chilensis MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 230, pl. 22, fig. 9. Lower California (?); Chile.

CALCINUS TIBICEN (Herbst).

Cancer tibicen HERBST, Naturg. d. Krabben u. Krebse, vol. 2, 1791, p. 25, pl. 23, fig. 7. Ecuador; West Indies.

Genus **DARDANUS** Paulson.**DARDANUS SINISTRIPES** (Stimpson). See page 556.

Lower California to Peru.

DARDANUS IMBRICATUS Rathbun. See page 556.

Bay of Seclura, Peru.

Genus **PETROCHIRUS** Stimpson.**PETROCHIRUS CALIFORNIENSIS** Bouvier.

Bull. Mus. Hist. Nat., Paris, 1895, p. 6. Lower California; Ecuador.

Genus **ANICULUS** Dana.**ANICULUS ELEGANS** Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 83. Lower California; Panama.

ANICULUS LONGITARSIS Streets.

Proc. Acad. Nat. Sci. Phila., 1871, p. 240. Panama.

Subfamily **PAGURINÆ** (=EUPAGURINÆ).Genus **PAGURUS** Fabricius.**PAGURUS GLADIUS** (Benedict).

Eupagurus gladius BENEDICT, Proc. U. S. Nat. Mus., vol. 15, 1892, p. 7. Gulf of California; Ecuador.

PAGURUS BENEDICTI (Bouvier). See page 557.

Gulf of California; Peru.

PAGURUS PURPURATUS (Benedict).

Eupagurus purpuratus BENEDICT, Proc. U. S. Nat. Mus., vol. 15, 1892, p. 15.

PAGURUS EDWARDSII (Dana).

Bernhardus edwardsii DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 447.—*Eupagurus edwardsi* LENZ, Zool. Jahrb., Suppl. vol. 5, 1902, p. 739, pl. 23, fig. 1. Callao, Peru; Chile.

PAGURUS OBESOCARPUS (Dana).

Bernhardus obesocarpus DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 445; atlas, 1855, pl. 27, fig. 5 a-d. Valparaiso (?), Chile; Coquimbo, Chile (Cunningham).

PAGURUS VILLOSUS Nicolet.

In Gay, Hist. Chile, Zool., vol. 3, 1849, p. 188; atlas, pl. 1, fig. 5. Chile.

PAGURUS PERLATUS Milne Edwards.

Ann. Sci. Nat., Zool. (3), vol. 10, 1848, p. 60. Chile.

PAGURUS BARBIGER (A. Milne Edwards).

Bernhardus barbiger A. MILNE EDWARDS, Crust. Miss. Sci. du Cap Horn, 1882, p. 28, pl. 3, fig. 1a-e. Chile; Straits of Magellan.

PAGURUS COMPTUS White.

Proc. Zool. Soc. London, pt. 15, 1847, p. 122.—*Eupagurus comptus* MIERS, *Erebus* and *Terror*, Crust., 1874, p. 3, pl. 2, fig. 5. Chile; Patagonia; Falkland Islands.

PAGURUS GAYI Nicolet.

In Gay, Hist. Chile, Zool., vol. 3, 1849, p. 190; atlas, pl. 1, fig. 6. Chile.

PAGURUS GAUDICHAUDII Milne Edwards.

Pagurus gaudichaudii MILNE EDWARDS, Ann. Sci. Nat., Zool. (2), vol. 6, 1836, p. 269. Valparaiso, Chile.

PAGURUS FORCEPS Milne Edwards.

Ann. Sci. Nat., Zool. (2), vol. 6, 1836, p. 272, pl. 13, fig. 5. Chile.

Genus **PORCELLANOPAGURUS** Filhol.**PORCELLANOPAGURUS PLATEI** Lenz.

Zool. Jahrb. Suppl. vol. 5, 1902, p. 740, pl. 23, fig. 2. Juan Fernandez.

Tribe **THALASSINIDEA**.Family **THALASSINIDÆ**.Genus **THALASSINA** Latreille.**THALASSINA ANOMALA** (Herbst).

Cancer (Astacus) anomalus HERBST, Naturg. d. Krabben u. Krebse, vol. 3, pt. 4, 1804, p. 45, pl. 62. Chile; Indo-Pacific region.

Family **CALLIANASSIDÆ**.Genus **CALLIANASSA** Leach.**CALLIANASSA UNCINATA** Milne Edwards. See page 557.

Peru; Chile, as far south as the island of Quehuy, off Chiloë.

Tribe GALATHEIDEA.

Family PORCELLANIDÆ.

Genus PETROLISTHES Stimpson.

PETROLISTHES ARMATUS (Gibbes). See page 558.

Lower California to Peru; Indo-Pacific region; Florida to Brazil; Bermudas.

PETROLISTHES VIOLACEUS (Guérin).

Porcellana violacea GUÉRIN, Voy. *Coquille*, Zool., vol. 2, pt. 2, 1831, p. 33, pl. 3, fig. 2. Ancon, Callao, San Lorenzo and Chincha Islands, Peru; Chile.

PETROLISTHES ANGULOSUS (Guérin).

Porcellana angulosa GUÉRIN, Bull. Soc. Sci. Nat. France, 1835, p. 115; Mag. de Zool., vol. 8, 1838, cl. 7, pp. 6, 7, pl. 25, fig. 3.

PETROLISTHES PUNCTATUS (Guérin).

Porcellana punctata GUÉRIN, Bull. Soc. Sci. Nat. France, 1835, p. 115; Icon., Crust. p. 13, pl. 18, fig. 1. Ancon and San Lorenzo, Peru; Chile.

PETROLISTHES SINUIMANUS Lockington.

Petrolisthes (Pisosoma) sinuimanus LOCKINGTON, Ann. Mag. Nat. Hist. (5), vol. 2, 1878, p. 401. Gulf of California; Ecuador.

PETROLISTHES HIANUS Nobili.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 17. Ecuador.

PETROLISTHES ORTMANNI Nobili.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 16. Ecuador.

PETROLISTHES, sp. [near **ORTMANNI**], Nobili.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 16. Ecuador.

PETROLISTHES SPINIFRONS (Milne Edwards). See page 559.

Peru; Chile.

PETROLISTHES HOLOTRICHUS Nobili.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 14. Ecuador.

PETROLISTHES GRACILIS Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 74. Guaymas, Mexico; Ecuador.

PETROLISTHES POLITUS (Gray).

Porcellana polita GRAY, Zool. Misc., 1831, p. 15; Griffith's Cuvier, Animal Kingdom, vol. 13, 1833, p. 312, pl. 25, fig. 2, (*Porcellaria*). Panama; Colon; West Indies.

PETROLISTHES EDWARDSII (Saussure).

Porcellana edwardsii SAUSSURE, Rev. et Mag. de Zool. (2), vol. 5, 1853, p. 366, pl. 12, fig. 3. Gulf of California to Ecuador.

PETROLISTHES GALATHINUS (Bosc).

Porcellana galathina BOSC, Hist. Nat. Crust., vol. 1, 1802, p. 233, pl. 6, fig. 2. Panama; South Carolina to Rio de Janeiro, Brazil.

PETROLISTHES TUBERCULATUS (Guérin).

Porcellana tuberculata GUÉRIN, Bull. Soc. Sci. Nat. France, 1835, p. 116; Mag. Zool., vol. 8, 1838, cl. 7, pp. 6, 7, pl. 26, fig. 2. San Lorenzo Island, Peru; Chile.

PETROLISTHES TUBERCULOSUS (Milne Edwards).

Porcellana tuberculosa MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 256. Peru; Chile.

PETROLISTHES PATAGONICUS (Cunningham).

Porcellana patagonica CUNNINGHAM, Trans. Linn. Soc. London, vol. 27, 1871, p. 495. Iquique, Chile; Port Otway, Patagonia; Straits of Magellan.

PETROLISTHES ACANTHOPHORUS (Milne Edwards and Lucas).

Porcellana acanthophora MILNE EDWARDS and LUCAS, d'Orbigny's Voy. Amér. MÉR., vol. 6, 1843, p. 33; vol. 9, atlas, 1847, pl. 16, fig. 2. Callao, Peru; Chile.

PETROLISTHES (?) DESMARESTII (Eydux and Gervais).

Porcellana desmarestii EYDOUX and GERVAIS, in Guérin, Bull. Soc. Sci. Nat. France, 1835, p. 115; Mag. de Zool., vol. 8, 1838, pp. 6, 7, pl. 26, fig. 1. Chile.

PETROLISTHES (?) LÆVIGATUS (Guérin).

Porcellana lævigata GUÉRIN, Bull. Soc. Sci. Nat. France, 1835, p. 115; Mag. de Zool., vol. 8, 1838, cl. 7, pp. 5, 6. Ecuador; Payta and Callao, Peru; Chile.

Genus **PACHYCHELES** Stimpson.

PACHYCHELES GROSSIMANUS (Guérin). See page 559.

Peru; Chile.

PACHYCHELES RUDIS Stimpson.

Ann. Lyc. Nat. Hist. N. Y., vol. 7, 1859, p. 76, pl. 1, fig. 5. Puget Sound to Lower California; Ecuador.

PACHYCHELES PANAMENSIS Faxon.

Bull. Mus. Comp. Zoöl., vol. 24, 1893, p. 175; Mem. Mus. Comp. Zoöl., vol. 18, 1895, p. 71, pl. 15, figs. 2, 2a. Panama; Ecuador; Bahamas (Ortmann).

PACHYCHELES VICARIUS Nobili.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 19. Ecuador.

Genus **PORCELLANA** Lamarck.**PORCELLANA MITRA** Dana.

Crust. U. S. Expl. Exped., pt. 1, 1852, p. 419; atlas, 1855, pl. 26, fig. 9a-b. Island of San Lorenzo, Peru.

PORCELLANA PULCHELLULA Cano.

Boll. Soc. Nat. Napoli (1), vol. 3, 1889, p. 260. San Lorenzo, Peru.

Genus **POLYONYX** Stimpson.**POLYONYX TUBERCULIPES** (Lockington).

Pachycheles tuberculipes LOCKINGTON, Ann. Mag. Nat. Hist. (5), vol. 2, 1878, p. 404. Gulf of California; Ecuador.

Genus **PORCELLANOPSIS**^a Rathbun.**PORCELLANOPSIS FESTÆ** (Nobili).

Porcellanides festæ NOBILI, Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 21. Ecuador.

Family **GALATHEIDÆ**.Genus **GALATHEA** Fabricius.**GALATHEA LENZI** Rathbun.

Revista Chilena Hist. Nat., vol. 11, 1907, p. 49, pl. 3, fig. 1. Corral, Province Valdivia, Chile.

Genus **CERVIMUNIDA** Benedict.**CERVIMUNIDA JOHNI** Porter.

Revista Chilena Hist. Nat., vol. 7, 1903, p. 276, text figs. 8 and 9, pl. 17. Chile.

Genus **MUNIDA** Leach.**MUNIDA GREGARIA** (Fabricius).

Galathea gregaria FABRICIUS, Ent. Syst., vol. 2, 1793, p. 473.—*Grimotea gregaria* MILNE EDWARDS, Règne Anim. de Cuvier, p. 124, pl. 47, fig. 2 (*Grimothea*). Calbuco, Chile; Straits of Magellan; Falkland Islands.

MUNIDA COKERI Rathbun. See page 559.

Peru.

^a *Porcellanopsis*, new genus, for *Porcellanides* Nobili, 1901, preoccupied by *Porcellanides* Czerniawsky, 1884, Crust. Decap. Pontica Littoralis, p. 109.

Genus PLEURONCODES Stimpson.

PLEURONCODES MONODON (Milne Edwards).

Galathea monodon MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 276; Ann. Sci. Nat., Zool. (3), vol. 16, 1851, p. 71, pl. 11, figs. 6-9. Chile (Milne Edwards); (?) off Acapulco, Mexico, 94 to 286 fathoms (Faxon).

Family ÆGLIDÆ.

Genus ÆGLA Leach.

ÆGLA LÆVIS (Latreille).

Galathea lævis LATREILLE, Tabl. Encyc. et Méth., pt. 24, 1818, pl. 308, fig. 2.—*Ægla lævis* LEACH, Dict. Sci. Nat., vol. 18, 1821, p. 49.—MILNE EDWARDS, Cuvier's Règne Anim., Atlas, Crust., "1849," pl. 47, fig. 3. Chile; northwest Patagonia; Argentina; Uruguay; southern Brazil. Fresh water, ranging from mountains to lowlands.

ÆGLA DENTICULATA (Nicolet).

In Gay, Hist. Chile, Zool., vol. 3, 1849, p. 200, pl. 2, fig. 1. Chile.

Tribe NEPHROPSIDEA.

Family ASTACIDÆ.

Genus PARASTACUS Huxley.

PARASTACUS CHILENSIS (Milne Edwards).^a

Astacus chilensis MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 333. Chile.

PARASTACUS HASSLERI Faxon.

Proc. U. S. Nat. Mus., vol. 20, 1898, p. 687, pl. 70, figs. 1-3. Talcahuano, Chile.

PARASTACUS NICOLETH Faxon.

Astacus chilensis NICOLET (not MILNE EDWARDS), in Gay, Hist. Chile, Zool., vol. 3, 1849, p. 211, pl. 1, fig. 4.—*Parastacus nicolethi* FAXON, Proc. U. S. Nat. Mus., vol. 20, 1898, p. 689. Chile.

PARASTACUS AGASSIZII Faxon.

Proc. U. S. Nat. Mus., vol. 20, 1898, p. 690, pl. 70, figs. 4, 5. Chile: Talcahuano; Lag. Llanquihué (Puerto Montt). Argentina.

^a Professor Bouvier has kindly examined the type of *Astacus chilensis* Milne Edwards and considers it a *Parastacus*, but of a different species from those enumerated by Faxon.

Tribe SCYLLARIDEA.

Family PALINURIDÆ.

Genus PALINUSTUS A. Milne Edwards.

PALINUSTUS FRONTALIS (Milne Edwards).

Palinurus frontalis MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 294. Chile (Milne Edwards); Juan Fernandez (Lenz).

Genus PANULIRUS White.

PANULIRUS ORNATUS (Fabricius). See page 560.

Lower California to Peru; Indo-Pacific region.

PANULIRUS PENICILLATUS (Olivier).

Astacus penicillatus OLIVIER, Encyc. Méth., Hist. Nat., Insectes, vol. 6, 1791, p. 343.—*Panulirus penicillatus* BATE, *Challenger* Macrura, 1888, p. 82, pl. 12, fig. 2. Galapagos Islands; Hawaiian Islands; South Pacific Islands to Red Sea.

Family SCYLLARIDÆ.

Genus SCYLLARUS Fabricius.

SCYLLARUS DELFINI (Bouvier).

Arctus delfini BOUVIER, Revista Chilena Hist. Nat., vol. 13, 1909, p. 213, text fig. 30. Juan Fernandez, Chile.

Genus EVIBACCUS Smith.

EVIBACCUS PRINCEPS Smith.

Amer. Jour. Sci. (2), vol. 42, 1866, p. 119. La Paz, Lower California; Panama; Ecuador.

Tribe CARIDEA.

Family GNATHOPHYLLIDÆ.

Genus GNATHOPHYLLUM Latreille.

GNATHOPHYLLUM PANAMENSE Faxon.

Bull. Mus. Comp. Zool., vol. 24, 1893, p. 198; Mem. Mus. Comp. Zool., vol. 18, 1895, p. 146, pl. E. Reef at Panama, low tide.

Family PONTONIIDÆ.

Genus CORALLIOCARIS Stimpson.

CORALLIOCARIS CAMERANI Nobil.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, 1901, no. 415, p. 3. Ecuador: Isola Flamenco.

Family PALÆMONIDÆ.

Genus BITHYNIS Philippi.

BITHYNIS CEMENTARIUS (Pöppig).

Palæmon cementarius PÖPPIG, Arch. f. Naturg., vol. 2, pt. 1, 1836, p. 143. Chile.

BITHYNIS CEMENTARIUS GAUDICHAUDII (Milne Edwards). See page 560.

Ecuador to Chile.

Genus MACROBRACHIUM Bate.

MACROBRACHIUM LAMARREI (Milne Edwards).

Palæmon lamarrei MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 397.—*Palæmon amazonicus* HELLER, Sitzungsab. Akad. Wiss. Wien, vol. 45, pt. 1, 1862, p. 418, pl. 2, fig. 45. Darien; Ecuador; Peru; Paraguay; Brazil; Guiana.

MACROBRACHIUM NATTERERI (Heller).

Palæmon nattereri HELLER, Sitzungsab. Akad. Wiss. Wien, vol. 45, pt. 1, 1862, p. 414, pl. 2, figs. 36, 37. Ecuador; Guiana; southern Brazil.

MACROBRACHIUM MEXICANUM (Saussure).

Palæmon mexicanus SAUSSURE, Mém. Soc. Phys. Hist. Nat. Genève, vol. 14, 1858, p. 468 [52], pl. 4, fig. 27, 27a. Cuba; Mexico; Isthmus of Panama.

MACROBRACHIUM ACANTHURUS (Wiegmann).

Palæmon acanthurus WIEGMANN, Arch. f. Naturg., vol. 2, pt. 1, 1836, p. 150. Panama; Ecuador; Texas to Rio Grande do Sul, Brazil; West Africa.

MACROBRACHIUM APPUNI ÆQUATORIALE (Ortmann).

Palæmon appuni, var. *æquatorialis* ORTMANN, Zool. Jahrb. Syst., vol. 5, 1891, p. 723, pl. 47, fig. 6. Ecuador.

MACROBRACHIUM OLFERSII (Wiegmann).

Palæmon olfersii WIEGMANN, Arch. f. Naturg., vol. 2, pt. 1, 1836, p. 150.—*Palæmon spinimanus* VON MARTENS, Arch. f. Naturg., vol. 35, pt. 1, 1869, p. 26, pl. 2, fig. 3. La Paz, Mexico, to Rio Sabana, Darien; West Indies to Rio de Janeiro; West Africa.

MACROBRACHIUM JAMAICENSE (Herbst). See page 561.

Fresh waters of Pacific slope of America from Lower California to Peru, and of Atlantic slope, from Texas to Brazil, including West Indies.

Genus PALÆMON Weber.

PALÆMON RITTERI Holmes. See page 561.

San Diego, California, to Peru.

Genus CRYPHIOPS Dana.

CRYPHIOPS SPINULOSOMANUS Dana.

Cryphiops spinuloso-manus DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 595; atlas, 1855, pl. 39, fig. 4a-h (*spinuloso-manus*). Chile, in fresh-water streams, 50 to 100 miles from the sea.

Family RHYNCHOCINETIDÆ.

Genus RHYNCHOCINETES Milne Edwards.

RHYNCHOCINETES TYPUS Milne Edwards. See page 562.

Peru; Chile; New Zealand; Australia; Indian Ocean.

Family HIPPOLYTIDÆ.

Genus HIPPOLYSMATA Stimpson.

HIPPOLYSMATA PORTERI Rathbun.

Revista Chilena Hist. Nat., vol. 11, 1907, p. 49, pl. 3, fig. 4. Bay of Valparaiso, Chile.

Genus NAUTICARIS Bate.

NAUTICARIS MARIONIS Bate.

Challenger Macrura, 1888, p. 603, pl. 108. Chile: Cavanha (Lenz). Off Falkland Islands, 12 fathoms; Indian Ocean, 69 to 140 fathoms.

Family CRANGONIDÆ (=ALPHEIDÆ).

Genus BETÆUS Dana.

BETÆUS TRUNCATUS Dana.

Crust. U. S. Expl. Exped., pt. 1, 1852, p. 559; atlas, 1855, pl. 35, fig. 10a-c. Chile to Straits of Magellan.

BETÆUS SCABRODIGITUS Dana.

Betæus scabro-digitus DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 560; atlas, 1855, pl. 35, fig. 12a-f. Chile.

BETÆUS, sp., Nobill.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 402, 1901, p. 3. San Vicente, Chile.

Genus ALPHEOPSIS Coutière.

ALPHEOPSIS CHILENSIS Coutière.

Ann. Sci. Nat., Zool. (8), vol. 9, 1899, p. 193, text fig. 232. Chile: Talcahuano; Juan Fernandez.

Genus SYNALPHEUS Bate.

SYNALPHEUS NOBILII Coutière.

Proc. U. S. Nat. Mus., vol. 36, 1909, p. 40, text fig. 22. St. Helena, Ecuador.

SYNALPHEUS LOCKINGTONI Coutière.

Alpheus læviusculus LOCKINGTON, Ann. Mag. Nat. Hist. (5), vol. 1, 1878, p. 474.—*Synalpheus lockingtoni* COUTIÈRE, Proc. U. S. Nat. Mus., vol. 36, 1909, p. 21, text fig. 1. Off San Nicolas Island, California, 229 to 298 fathoms; Gulf of California; Baía di S. Elena, Ecuador.

SYNALPHEUS LATASTEI Coutière. See page 562.

Peru; Chile; Australia (?).

SYNALPHEUS TOWNSENDI PERUVIANUS Rathbun. See page 563.

Matapalo, Peru.

SYNALPHEUS DIGUETI ECUADORENSIS Coutière.

Proc. U. S. Nat. Mus., vol. 36, 1909, p. 49, text fig. 28, *aa*, *cc*. St. Helena, Ecuador.

SYNALPHEUS SPINIFRONS (Milne Edwards).

Alpheus spinifrons MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 355.—NICOLET, in Gay, Hist. Chile, Zool., vol. 3, 1849, p. 214; atlas, vol. 2, 1854, Crust., pl. 2, fig. 2, *2a*. Chile.

Genus CRANGON Weber (=ALPHEUS Fabricius).

CRANGON BOUVIERI CHILENSIS (Coutière).

Alpheus bouvieri, var. *chilensis* COUTIÈRE, in Lenz, Zool. Jahrb., Suppl. vol. 5, 1902, p. 732. Calbuco, Chile.

CRANGON CLAMATOR (Lockington).

Alpheus clamator LOCKINGTON, Proc. Cal. Acad. Sci., vol. 7, 1876 (1877), p. 43.—HOLMES, Occas. Papers Cal. Acad. Sci., vol. 7, 1900, p. 182, pl. 2, figs. 39, 40. Farallon Islands, California, to San Bartolome Bay, Lower California; Panama.

CRANGON HETEROCHELIS (Say).

Alpheus heterochelis SAY, Jour. Acad. Nat. Sci. Phila., vol. 1, 1818, p. 243.—*Alpheus heterochelis* HERRICK, Mem. Nat. Acad. Sci., vol. 5, 1891, p. 372, pl. 2. West coast of Nicaragua and Panama (Kingsley); Punta di Sant 'Elena, Ecuador (Nobili); east coast of North America.

CRANGON MAINDRONI (Coutière).

Alpheus maindroni COUTIÈRE, Bull. Soc. Ent. France, 1898, p. 133, figs. 2, 2'. Puerto Montt, Chile; Mascate and Djibouti (Coutière).

CRANGON MALLEATOR (Dana).

Alpheus malleator DANA, Crust. U. S. Expl. Exped., pt. 1, 1852, p. 557; atlas, 1855, pl. 31, fig. 9. Baia di S. Elena, Ecuador; Galapagos Islands; Rio de Janeiro, Brazil (?); Cape Verde Islands.

CRANGON PANAMENSIS (Kingsley).

Alpheus panamensis KINGSLEY, Bull. U. S. Geol. Surv., vol. 4, 1878, p. 192. Acajutla, Salvador; Panama.

CRANGON, *sp.*

Alpheus sp., NOBILI, Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 3. Punta di S. Elena, Ecuador.

Family PANDALIDÆ.

Genus PANDALUS Leach.

PANDALUS PAUCIDENS Miers.

Proc. Zool. Soc. London, 1881, p. 74, pl. 7, figs. 6 and 7. Chile: Calbuco; Cavancha. Patagonia.

Family DISCIDÆ.

Genus DISCIAS Rathbun.

DISCIAS SERRIFER Rathbun.

Proc. Wash. Acad. Sci., vol. 4, 1902, p. 290, text figs. 2-4. Galapagos Islands, on reef.

Tribe PENEIDEA.

Family PENEIDÆ.

Genus PENEUS Weber.

PENEUS BREVIROSTRIS Kingsley. See page 564.

San Francisco Bay, California, to Peru; Galapagos Islands.

PENEUS STYLIROSTRIS (Stimpson). See page 564.

Panama; Peru.

Genus METAPENÆUS Wood-Mason.

METAPENÆUS GOODEI (Smith).

Parapenæus goodei SMITH, Proc. U. S. Nat. Mus., vol. 8, 1885, p. 176. Bay of Panama; North Carolina to Brazil; Bermuda.

Genus PARAPENÆUS Smith.

PARAPENÆUS KISHINOUEI Rathbun.

Proc. Wash. Acad. Sci., vol. 4, 1902, p. 288, pl. 12, figs. 13-15. Galapagos Islands, on reef, and also at 2 fathoms.

Genus XIPHOPENEUS Smith.

XIPHOPENEUS RIVETI Bouvier.

Bull. Mus. Hist. Nat., Paris, 1907, No. 2, p. 113, text fig. 1. Payta, Peru.

Order STOMATOPODA.

Family CHLORIDELLIDÆ.

Genus CHLORIDELLA Miers.

CHLORIDELLA ARMATA (Milne Edwards).

Squilla armata MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 521. Chile: Valparaiso Bay; Talcahuano.

CHLORIDELLA DUBIA (Milne Edwards). See page 565.

Ecuador; Peru; South Carolina; Georgia.

CHLORIDELLA PARVA (Bigelow).

Squilla parva BIGELOW, Proc. U. S. Nat. Mus., vol. 17, 1894, p. 518, text figs. 11, 12. Off Manzanillo, Mexico; Bay of Panama, 7 to 16 fathoms.

CHLORIDELLA ACULEATA (Bigelow).

Squilla aculeata BIGELOW, Johns Hopkins Univ. Circ., vol. 12, 1893, p. 101; Proc. U. S. Nat. Mus., vol. 17, 1894, p. 523, text figs. 15, 16. Panama; Iquique, Chile.

Genus GONODACTYLUS Latreille.

GONODACTYLUS FESTÆ Nobili.

Boll. Mus. Zool. Anat. comp. R. Univ. Torino, vol. 16, no. 415, 1901, p. 53. Ecuador.

Genus PSEUDOSQUILLA Dana.

PSEUDOSQUILLA LESSONII (Guérin). See page 565.

Wilmington, California, to Chile.

PSEUDOSQUILLA BIGELOWI Rathbun.^a

Gonodactylus styliferus MILNE EDWARDS, Hist. Nat. Crust., vol. 2, 1837, p. 530, pl. 27, figs. 9-14. Chile; California; Australia.

Genus LYSIOSQUILLA Dana.

LYSIOSQUILLA POLYDACTYLA von Martens.

Sitzungsb. Ges. naturf. Fr. Berlin, 1881, p. 92. Locality unknown, probably Chile.

LYSIOSQUILLA DECEMSPINOSA Rathbun. See page 566.

Capon, Peru.

^a New name for *P. stylifera* (Milne Edwards, 1837), not *P. stylifera* (Lamarck, 1818) Dana.

SPECIES OF WHICH THE LOCALITY IS INCORRECT OR DOUBTFUL.

- Actæa hirsutissima* (Rüppell). Payta (Cano).
Calappa granulata (Linnæus). Panama (Cano).
Calappa hepatica (Linnæus). Payta (Cano).
Carpilius maculatus (Linnæus). Payta (Cano).
Ceratoplax ciliata Stimpson. Ecuador (Cano).
Cosmonotus grayi White. Callao (Cano).
Dorippe dorsipes (Linnæus). Payta (Cano).
Epixanthus frontalis (Milne Edwards). Panama (Cano).
Eriphia lævimana var. *smithii* McLeay." Panama (Cano).
Euryozius bouvieri var. *mellissii* Miers." Panama (Cano).
Leptodius exaratus var. *sanguineus* (Milne Edwards)." Payta (Cano).
Neptunus (Amphitrite) gladiator var. *argentatus* White." Payta (Cano).
Ozius rugosus Milne Edwards and Lucas." Chile (Milne Edwards and Lucas).
Podophthalmus vigil (Fabricius). Payta (Cano).
Remipes adactylus (Fabricius)." Valparaiso? (Ortmann).
Thalamita integra Dana. Payta (Cano).

SPECIES WHICH ARE INDETERMINABLE.

- Atelecyclus dilatatus* Philippi. *Nomen nudum*. Chile.
"Callianassa gigas Dana?" San Carlos de Ancud, Chiloë (Cunningham).
Cancer apancora Molina. Chile.
Cancer cæmentarius Molina. Chile.
Cancer coronatus Molina. Chile. Perhaps = *Cancer plebejus* Pöppig.
Cancer talicuna Molina. Chile.
"Gelasimus pugilator" Cano, not (Bosc). Panama.
"Gelasimus vocator" Cano. Gulf of Panama.
Primela chilensis Philippi. *Nomen nudum*. Chile.
Uca vocator Doflein. Guayaquil, Ecuador.
Uca vocator, var., Nobili. Esmeraldas, Ecuador.
Xantho parvulus Cano. Panama.

SUMMARY OF SYNONYMS.

- Abrote spinimana* Philippi = *Blepharipoda occidentalis* Randall.
Acanthocyclus gay Targioni-Tozzetti = *Acanthocyclus albatrossis* Rathbun.
Acanthocyclus gayi Miers = ? *Acanthocyclus albatrossis* Rathbun.
Acanthocyclus gayi Strahl = *Acanthocyclus albatrossis* Rathbun.
Acanthocyclus villosus Strahl = *Acanthocyclus gayi* Milne Edwards and Lucas.
Acanthonyx concamerata Kinahan = *Acanthonyx petiverii* Milne Edwards.
Acanthonyx debilis Dana = *Acanthonyx petiverii* Milne Edwards.
Acanthonyx emarginatus Milne Edwards and Lucas = *Acanthonyx petiverii* Milne Edwards.
Acanthoplar insignis Milne Edwards = *Uca insignis* (Milne Edwards).
Acanthopus clavimanus Krauss = *Pernon planissimum* (Herbst).
Acanthopus gibbesi Milne Edwards = *Pernon planissimum* (Herbst).
Acanthus spinohirsutus Lockington = *Pilumnus spinohirsutus* (Lockington).
Acheloüs acuminatus Stimpson = *Portunus (Portunus) acuminatus* (Stimpson).
Acheloüs brevimanus Faxon = *Portunus (Acheloüs) brevimanus* (Faxon).
Acheloüs panamensis Stimpson = *Portunus (Portunus) panamensis* (Stimpson).
Acheloüs smithii Verrill = *Portunus (Acheloüs) spinimanus* (Latreille).
Acheloüs spinimanus Faxon = *Portunus (Acheloüs) brevimanus* (Faxon).

- Achelois transversus* Stimpson = *Portunus* (*Portunus*) *transversus* (Stimpson).
Achelois xantusii Stimpson = *Portunus* (*Portunus*) *xantusii* (Stimpson).
Actæa labyrinthica Stimpson = *Glyptoxanthus labyrinthicus* (Stimpson).
Actæa meandrica Lockington = *Glyptoxanthus labyrinthicus* (Stimpson).
Actæodes mexicanus Lockington = *Xanthodius sternberghii* Stimpson.
Æglea lævigata Milne Edwards and Lucas = *Ægla lævis* (Latreille).
Æglea odebrechtii Fritz Müller = *Ægla lævis* (Latreille).
Albunæa scutellata Dana = ? *Lepidoda chilensis* Lenz.
Albunhippa spinosa Milne Edwards and Lucas = *Blepharipoda occidentalis* Randall.
Alpheus bouvieri chilensis Coutière = *Crangon bouvieri chilensis* (Coutière).
Alpheus clamator Lockington = *Crangon clamator* (Lockington).
Alpheus heterochælis Say = *Crangon heterochælis* (Say).
Alpheus lævigatus Nicolet = ? *Betæus truncatus* Dana.
Alpheus levinusculus Lockington = *Synalpheus lockingtoni* Coutière.
Alpheus maindroni Coutière = *Crangon maindroni* (Coutière).
Alpheus malleator Dana = *Crangon malleator* (Dana).
Alpheus panamensis Kingsley = *Crangon panamensis* (Kingsley).
Alpheus pugilator A. Milne Edwards = *Crangon malleator* (Dana).
Alpheus scabrodigitus Miers = *Betæus scabrodigitus* Dana.
Alpheus, sp., Nobili = *Crangon*, sp.
Alpheus spinifrons Milne Edwards = *Synalpheus spinifrons* (Milne Edwards).
Amphitrite edwardsii Lockington = *Cronius edwardsii* (Lockington).
Amphitrite paucispinis Lockington = *Portunus* (*Portunus*) *panamensis* (Stimpson).
Arctus delfini Bouvier = *Scyllarus delfini* (Bouvier).
Arenæus bidens Smith = *Arenæus mexicanus* (Gerstæcker).
Arca septemdentata White = *Trichodactylus* (*Dilocarcinus*) *orbicularis* (Meuschen).
Astacus chilensis Milne Edwards = *Parastacus chilensis* (Milne Edwards).
Atecyclus spinulosus White = *Hypopeltarium spinulosum* (White).
Atergatis cristatissimus Lockington = *Platypodia rotundata* (Stimpson).
Atergatis rotundatus Stimpson = *Platypodia rotundata* (Stimpson).
Bernhardus æquimanus Dana = *Isocheles æquimanus* (Dana).
Bernhardus barbiger A. Milne Edwards = *Pagurus barbiger* (A. Milne Edwards).
Bernhardus edwardsii Dana = *Pagurus edwardsii* (Dana).
Bernhardus obesocarpus Dana = *Pagurus obesocarpus* (Dana).
Bernhardus perlatus Kinahan, not Milne Edwards = *Pagurus edwardsii* (Dana).
Bithynis forceps Bate = *Macrobrachium acanthurus* (Wiegmann).
Bithynis jamaicensis Bate = *Macrobrachium jamaicense* (Herbst).
Bithynis longimana Philippi = *Bithynis cæmentarius gaudichaudii* (Milne Edwards).
Bithynis spinimanus Bate = *Macrobrachium olfersii* (Wiegmann).
Blepharopoda spinimana (Philippi) = *Blepharipoda occidentalis* Randall.
Blepharopoda spinosa Stimpson = *Blepharipoda occidentalis* Randall.
Boscia chilensis Milne Edwards = *Pseudothelphusa chilensis* (Milne Edwards and Lucas).
Boscia dentata Milne Edwards = *Pseudothelphusa dentata* (Latreille).
Boscia macropa Milne Edwards = *Pseudothelphusa macropa* (Milne Edwards).
Calappa angustata Fabricius = *Hepatus angustatus* (Fabricius).
Calappa flammea Cano, not (Herbst) = ? *Calappa convexa* Saussure.
Calappa xantusiana Stimpson = *Calappa convexa* Saussure.
Cancer (*Astacus*) *jamaicensis* Herbst = *Macrobrachium jamaicense* (Herbst).
Cancer chabrus Linnæus = *Plagusia chabrus* (Linnæus).
Cancer dentatus Bell = *Cancer polyodon* Pœppig.
Cancer emeritus Linnæus = *Emerita emerita* (Linnæus).
Cancer grapsus Linnæus = *Grapsus grapsus* (Linnæus).
Cancer irroratus Bell, not Say = *Cancer plebejus* Pœppig.
Cancer minutus Linnæus = *Planes minutus* (Linnæus).

- Cancer mutilatus* Herbst=? *Trichodactylus* (*Dilocarcinus*) *pictus* (Milne Edwards).
Cancer orbicularis Meuschen=? *Trichodactylus* (*Dilocarcinus*) *orbicularis* (Meuschen).
Cancer planatus Fabricius=? *Halicarcinus planatus* (Fabricius).
Cancer planipes Seba=? *Percnon planissimum* (Herbst).
Cancer planissimus Herbst=? *Percnon planissimum* (Herbst).
Cancer pusillus Fabricius=? *Planes minutus* (Linnaeus).
Cancer santolla Molina=? *Lithodes antarctica* Jacquinot.
Cancer septemdentatus Herbst=? *Trichodactylus* (*Dilocarcinus*) *orbicularis* (Meuschen).
Cancer setosus Molina=? *Cancer polyodon* Pöppig.
Cancer (*Thelphusa*) *dentatus* de Haan=? *Pseudothelphusa dentata* (Latreille).
Cancer tibicen Herbst=? *Calcinus tibicen* (Herbst).
Cancer variegatus Fabricius=? *Leptograpsus variegatus* (Fabricius).
Cancer zaiva Molina=? *Epialtus dentatus* Milne Edwards.
Cænobita intermedia Streets=? *Cænobita panamensis* Streets.
Charybdelta edwardsii Rathbun=? *Cronius edwardsii* (Lockington).
Chlorodius fisheri Lockington=? *Leptodius occidentalis* (Stimpson).
Chlorodius occidentalis Stimpson=? *Leptodius occidentalis* (Stimpson).
Cænobita clypeata Owen=? *Cænobita rugosus* Milne Edwards.
Cænobita compressa, var. *rugosa* Bouvier=? *Cænobita rugosus* Milne Edwards.
Cænobita compressus de Man, not Guérin=? *Cænobita rogosus* Milne Edwards.
Corystes sicarius Pöppig=? *Pseudocorystes sicarius* (Pöppig).
Corystoides armatus Philippi=? *Pseudocorystes sicarius* (Pöppig).
Cronius ruber Nobili, not (Lamarck)=? *Cronius edwardsii* (Lockington).
Cryptograpsus cirripes Smith=? *Cyrtograpsus angulatus* Dana.
Cyclograpsus crenulatus Milne Edwards=? *Hemigrapsus crenulatus* (Milne Edwards).
Cyclograpsus (?) *gnathæion* Kinahan=? *Pinnotherelia lævigata* Milne Edwards and Lucas.
Cyclograpsus minutus Jacquinot and Lucas=? *Cyclograpsus punctatus* Milne Edwards.
Cyclograpsus punctatus Kinahan, not Milne Edwards=? *Cyclograpsus cinereus* Dana.
Dilocarcinus cryptodus Ortmann=? *Trichodactylus* (*Dilocarcinus*) *emarginatus* (Milne Edwards).
Dilocarcinus emarginatus Milne Edwards=? *Trichodactylus* (*Dilocarcinus*) *emarginatus* (Milne Edwards).
Dilocarcinus margaritifrons Ortmann=? *Trichodactylus* (*Valdivia*) *margaritifrons* (Ortmann).
Dilocarcinus pagei Stimpson=? *Trichodactylus* (*Dilocarcinus*) *orbicularis* (Meuschen).
Dilocarcinus pardalinus Gerstæcker=? *Trichodactylus* (*Valdivia*) *pardalinus* (Gerstæcker).
Dilocarcinus pictus Milne Edwards=? *Trichodactylus* (*Dilocarcinus*) *pictus* (Milne Edwards).
Dilocarcinus septemdentatus Gerstæcker=? *Trichodactylus* (*Dilocarcinus*) *orbicularis* (Meuschen).
Dilocarcinus spinifrons Kingsley=? *Trichodactylus* (*Valdivia*) *peruvianus* (A. Milne Edwards).
Epialtus affinis Stimpson=? *Epialtus bituberculatus* Milne Edwards.
Epialtus brasiliensis Dana=? *Epialtus bituberculatus* Milne Edwards.
Epialtus dilatatus A. Milne Edwards=? *Epialtus bituberculatus* Milne Edwards.
Epialtus minimus Lockington=? *Epialtus bituberculatus* Lockington.
Epialtus sulcirostris Stimpson=? *Epialtus bituberculatus* Lockington.
Eriphia hispida Stimpson=? *Eriphides hispida* (Stimpson).
Euctenota mexicana Gerstæcker=? *Arenæus mexicanus* (Gerstæcker).
Eupagurus barbiger Lenz=? *Pagurus barbiger* A. Milne Edwards.
Eupagurus benedicti Bouvier=? *Pagurus benedicti* (Bouvier).
Eupagurus comptus Stimpson=? *Pagurus comptus* White.
Eupagurus edwardsii Lenz=? *Pagurus edwardsii* (Dana).
Eupagurus gladius Benedict=? *Pagurus gladius* (Benedict).

- Eupagurus minutus* Benedict=*Pagurus benedicti* (Bouvier).
Eupagurus obesocarpus Stimpson=*Pagurus obesocarpus* (Dana).
Eupagurus perlatus Stimpson=*Pagurus perlatus* Milne Edwards.
Eupagurus purpuratus Benedict=*Pagurus purpuratus* (Benedict).
Eurypodius audouinii Milne Edwards and Lucas=*Eurypodius latreillii* Guérin.
Eurypodius brevipes Dana=*Eurypodius latreillii* Guérin.
Eurypodius septentrionalis Dana=*Eurypodius latreillii* Guérin.
Eurypodius tuberculatus Eydoux and Souleyet=*Eurypodius latreillii* Guérin.
Fabia chilensis Dana=*Pinnazodes chilensis* (Milne Edwards).
Galathea gregaria Fabricius=*Munida gregaria* (Fabricius).
Galathea laevis Latreille=*Ægla laevis* (Latreille).
Galathea latirostris Lenz, not Dana=*Galathea lenzi* Rathbun.
Galathea monodon Milne Edwards=*Pleuroncodes monodon* (Milne Edwards).
Gecarcinus barbiger Poëppig=*Parazanthus barbiger* (Poëppig).
Gecarcinus depressus Saussure=*Gecarcinus lateralis* (Fremenville).
Gecarcinus regius Poëppig=*Homalaspis plana* (Milne Edwards).
Gecarcinus ruricola Cano, Nobili, not (Linnæus)=*Gecarcinus lateralis* (Fremenville).
Gelasimus (*Acanthoplax*) *excellens* Gerstaecker=*Uca insignis* (Milne Edwards).
Gelasimus armatus Smith=*Uca insignis* (Milne Edwards).
Gelasimus brevifrons Stimpson=*Uca brevifrons* (Stimpson).
Gelasimus gibbosus Smith=*Uca stenodactylus* (Milne Edwards and Lucas).
Gelasimus heterocheles Kingsley (part)=*Uca princeps* (Smith).
Gelasimus heterophthalmus Smith=*Uca stylifera* (Milne Edwards).
Gelasimus insignis Smith=*Uca insignis* (Milne Edwards).
Gelasimus latimanus Rathbun=*Uca latimanus* (Rathbun).
Gelasimus macrodactylus Milne Edwards and Lucas=*Uca macrodactylus* (Milne Edwards and Lucas).
Gelasimus ornatus Smith=*Uca insignis* (Milne Edwards).
Gelasimus panamensis Stimpson=*Uca panamensis* (Stimpson).
Gelasimus platydactylus Milne Edwards in Régne Anim., not Milne Edwards, 1837=*Uca stylifera* (Milne Edwards).
Gelasimus platydactylus Saussure=? *Uca princeps* (Smith).
Gelasimus princeps Smith=*Uca princeps* (Smith).
Gelasimus stenodactylus Milne Edwards and Lucas=*Uca stenodactylus* (Milne Edwards and Lucas).
Gelasimus styliferus Milne Edwards=*Uca stylifera* (Milne Edwards).
Gelasimus vocator Kingsley (part)=*Uca brevifrons* (Stimpson).
Geograpsus occidentalis Stimpson=*Geograpsus lividus* (Milne Edwards).
Geothelphusa chilensis Heller=*Potamon* (*Geothelphusa*) *chilensis* (Heller).
Glyptograpsus spinipes Cano=*Glyptograpsus impressus* Smith.
Gnathochasmus barbatus McLeay=*Cyclograpsus punctatus* Milne Edwards.
Goniograpsus innotatus Dana=*Pachygrapsus transversus* (Gibbes).
Goniograpsus pulcher Lockington=*Goniopsis pulchra* (Lockington).
Goniograpsus simplex Kinahan=? *Pachygrapsus crassipes* Randall.
Goniopsis cruentatus Cano, part, not de Haan=? *Goniopsis pulchra* (Lockington).
Gonodactylus chiragra Nobili, 1897=*Gonodactylus festæ* Nobili.
Gonodactylus styliferus Milne Edwards=*Pseudosquilla stylifera* (Milne Edwards).
Grapsus altifrons Stimpson=*Grapsus grapsus* (Linnæus).
Grapsus brevipes Milne Edwards=*Geograpsus lividus* (Milne Edwards).
Grapsus cinereus Say, not Boec=*Planes minutus* (Linnæus).
Grapsus declivifrons Heller=*Pachygrapsus transversus* (Gibbes).
Grapsus diris Costa=*Planes minutus* (Linnæus).
Grapsus eydouri Milne Edwards=*Pachygrapsus crassipes* Randall.
Grapsus (*Grapsus*) *pusillus* de Haan=*Planes minutus* (Linnæus).

- Grapsus lividus* Milne Edwards=*Geograpsus lividus* (Milne Edwards).
Grapsus maculatus Milne Edwards=*Grapsus grapsus* (Linnæus).
Grapsus minutus Latreille=*Planes minutus* (Linnæus).
Grapsus ornatus Milne Edwards=*Grapsus grapsus* (Linnæus).
Grapsus pelagicus Say=*Planes minutus* (Linnæus).
Grapsus personatus Lamarck=*Leptograpsus variegatus* (Fabricius).
Grapsus pictus Latreille=*Grapsus grapsus* (Linnæus).
Grapsus planifrons Dana=*Leptograpsus variegatus* (Fabricius).
Grapsus strigosus Kinahan=? *Grapsus grapsus* (Linnæus).
Grapsus testudinum Roux=*Planes minutus* (Linnæus).
Grapsus transversus Gibbes=*Pachygrapsus transversus* (Gibbes).
Grapsus variegatus Latreille=*Leptograpsus variegatus* (Fabricius).
Grapsus webbi Milne Edwards=*Grapsus grapsus* (Linnæus).
Grimotea gregaria Guérin, not Leach=*Munida cokeri* Rathbun.
Grimothea gregaria Leach=*Munida gregaria* (Fabricius).
Guania (ilia) jurinei Saussure=*Leucosilia jurinei* (Saussure).
Hemigrapsus sanguineus Lenz, not Milne Edwards=*Hemigrapsus crenulatus* (Milne Edwards).
Hepatus angustatus Kinahan, Cano, and Lenz, not (Fabricius)=*Hepatus kossmanni* Neumann.
Hepatus perlatus Pœppig=*Pilumnoides perlatus* (Pœppig).
Heteractæa pilosus Lockington=*Heteractæa lunata* (Milne Edwards and Lucas).
Hippa analoga Stimpson=*Emerita analoga* (Stimpson).
Hippa emerita Dana=*Emerita emerita* (Linnæus).
Hippa talpoides Dana=*Emerita analoga* (Stimpson).
Hyas edwardsii Bell=*Pisoides edwardsii* (Bell).
Hymenosoma tridentatum Jacquinot and Lucas=? *Haliscarcinus planatus* (Fabricius).
Hypolobocera chilensis Ortmann=*Pseudothelphusa chilensis* (Milne Edwards and Lucas).
Inachus mitis Pœppig=*Epialtus dentatus* Milne Edwards.
Inachus tuberculatus Lockington=*Dasygygius tuberculatus* (Lockington).
Lambrus hyponcus Stimpson=*Parthenope (Parthenope) hyponcus* (Stimpson).
Leander ritleri Nobili=*Palæmon ritleri* Holmes.
Leiolophus planissimus Miers=*Pernon planissimum* (Herbst).
Leptodius lobatus A. Milne Edwards=*Xanthodius lobatus* (A. Milne Edwards).
Leptodius sternberghii A. Milne Edwards=*Xanthodius sternberghii* Stimpson.
Leptograpsus ansoni Milne Edwards=*Leptograpsus variegatus* (Fabricius).
Leptograpsus gayi Milne Edwards=*Leptograpsus variegatus* (Fabricius).
Leptograpsus rugulosus Milne Edwards=*Pachygrapsus transversus* (Gibbes).
Leptograpsus verreauxi Milne Edwards=*Leptograpsus variegatus* (Fabricius).
Leptopodia debilis Smith=*Stenorynchus debilis* (Smith).
Leptopodia modesta A. Milne Edwards=*Stenorynchus debilis* (Smith).
Leptopodia sagittaria Milne Edwards and Lucas, not (Fabricius)=*Stenorynchus debilis* (Smith).
Leucippa ensenadæ Milne Edwards and Lucas=*Leucippa pentagona* Milne Edwards.
Leucippa lævis Dana=*Leucippa pentagona* Milne Edwards.
Leucosia pacifica Pœppig=? *Cyclograpsus cinereus* Dana.
Liriopsea leachii Nicolet=? *Haliscarcinus planatus* (Fabricius).
Liriopsea lucasii Nicolet=? *Haliscarcinus planatus* (Fabricius).
Lophactæa rotundata A. Milne Edwards=*Platypodia rotundata* (Stimpson).
Macrobrachium americanum Bate=*Macrobrachium jamaicense* (Herbst).
Metopograpsus dubius Saussure=*Pachygrapsus transversus* (Gibbes).
Metopograpsus miniatus Saussure=*Pachygrapsus transversus* (Gibbes).
Microphrys error Kingsley=*Microphrys platysoma* (Stimpson).
Microrhynchus depressus Bell=*Dasygygius depressus* (Bell).

- Microrhynchus gibbosus* Bell=*Dasygygius gibbosus* (Bell).
Microrhynchus (*Inachus*) *tuberculatus* Lockington=*Dasygygius tuberculatus* (Lockington).
Milnia platysoma Stimpson=*Microphrys platysoma* (Stimpson).
Mitraculus areolatus Lockington=*Mithrax areolatus* (Lockington).
Mithrax (*Teleophrys*) *crisulipes* A. Milne Edwards=*Teleophrys crisulipes* Stimpson.
Mithrax ursus Bell=*Mithrax bellii* Gerstæcker.
Mitraculus ruber Cano, not Stimpson=? *Mithrax nodosus* Bell.
Mitraculus tumidus Cano=*Mithrax tumidus* (Cano).
Myra townsendi Rathbun=*Persephona townsendi* (Rathbun).
Nautilograpsus angustatus Stimpson=*Planes minutus* (Linnæus).
Nautilograpsus major McLeay=*Planes minutus* (Linnæus).
Nautilograpsus minutus Milne Edwards=*Planes minutus* (Linnæus).
Nautilograpsus smithii McLeay=*Planes minutus* (Linnæus).
Nemausa spinipes A. Milne Edwards=*Mithrax spinipes* (Bell).
Neorhynchus depressus A. Milne Edwards=*Dasygygius depressus* (Bell).
Neorhynchus gibbosus A. Milne Edwards=*Dasygygius gibbosus* (Bell).
Neorhynchus mexicanus Rathbun=*Dasygygius tuberculatus* (Lockington).
Neptunus acuminatus A. Milne Edwards=*Portunus acuminatus* (Stimpson).
Neptunus asper A. Milne Edwards=*Portunus xantusii* (Stimpson).
Neptunus (*Callinectes*) *dianthus* Ortmann, part (from southern Chile)=either *Callinectes arcuatus* Ordway or *C. toxoles* Ordway.
Neptunus cribrarius Cano, not (Lamarck)=*Arenæus mexicanus* (Gerstæcker).
Neptunus dianthus Cano and Doflein, part, not (Latreille)=*Callinectes*, species indeterminate.
Neptunus mexicanus A. Milne Edwards=*Arenæus mexicanus* (Gerstæcker).
Neptunus panamensis A. Milne Edwards=*Portunus panamensis* (Stimpson).
Neptunus transversus A. Milne Edwards=*Portunus transversus* (Stimpson).
Neptunus xantusii A. Milne Edwards=*Portunus xantusii* (Stimpson).
Ocypoda lateralis Freminville=*Gecarcinus lateralis* (Freminville).
Ocypoda urvillei Doflein, not Milne Edwards=? *Ocypode occidentalis* Stimpson.
Ocypode (*Acanthopus*) *clavimana* de Haan=*Pernon planissimum* (Herbst).
Ocypode (*Acanthopus*) *serripes* de Haan=*Pernon planissimum* (Herbst).
Edipleura occidentalis Ortmann=*Ucides occidentalis* (Ortmann).
Orthograpsus hillii Kingsley=*Geograpsus lividus* (Milne Edwards).
Orthostoma emarginatum Ortmann=*Trichodactylus* (*Dilocarcinus*) *emarginatus* (Milne Edwards).
Orthostoma latidens Ortmann=*Trichodactylus* (*Valdivia*) *latidens* (A. Milne Edwards).
Orthostoma margaritifrons Ortmann=*Trichodactylus* (*Valdivia*) *margaritifrons* (Ortmann).
Orthostoma pardalinum Ortmann=*Trichodactylus* (*Valdivia*) *pardalinus* (Gerstæcker).
Orthostoma peruvianum Ortmann=*Trichodactylus* (*Valdivia*) *peruvianus* (A. Milne Edwards).
Orthostoma pictum Ortmann=*Trichodactylus* (*Dilocarcinus*) *pictus* (Milne Edwards).
Orthostoma septemdentatum Ortmann=*Trichodactylus* (*Dilocarcinus*) *orbicularis* (Meuschen).
Othonia aculeata (?) Cano, not (Gibbes)=? *Pitho quinquedentata* (Bell).
Othonia mirabilis Cano, not (Herbst)=*Pitho sexdentata* (Bell).
Othonia sexdentata Bell=*Pitho sexdentata* (Bell).
Ozius rugosus Milne Edwards and Lucas=*Lydia tenax* (Rüppell).
Pachycheles lævidactylus Ortmann=*Pachycheles grossimanus* (Guérin).
Pachygrapsus advena Catta=*Pachygrapsus transversus* (Gibbes).
Pachygrapsus intermedius Heller=*Pachygrapsus transversus* (Gibbes).
Pachygrapsus lævimanus Stimpson=*Pachygrapsus transversus* (Gibbes).

- Pachygrapsus socius* Stimpson = *Pachygrapsus transversus* (Gibbes).
Pagurus chilensis Milne Edwards = *Calcinus chilensis* (Milne Edwards).
Pagurus maculatus Catesby = *Grapsus grapsus* (Linnæus).
Pagurus sinistripes Stimpson = *Dardanus sinistripes* (Stimpson).
Pagurus tibicen Bosc = *Calcinus tibicen* (Herbst).
Pagurus tomentosus Milne Edwards = *Paguristes tomentosus* (Milne Edwards).
Pagurus weddellii Milne Edwards = *Paguristes weddellii* (Milne Edwards).
Palæmon acanthurus Wiegmann = *Macrobrachium acanthurus* (Wiegmann).
Palæmon africanus Kingsley = *Macrobrachium acanthurus* (Wiegmann).
Palæmon amazonicus Heller = *Macrobrachium lamarrei* (Milne Edwards).
Palæmon appuni, var. *æquatorialis* Ortmann = *Macrobrachium appuni æquatoriale* (Ortmann).
Palæmon aztecus Saussure = *Macrobrachium jamaicense* (Herbst).
Palæmon brachydactylus Wiegmann = *Macrobrachium jamaicense* (Herbst).
Palæmon brasiliensis Heller = *Macrobrachium nattereri* (Heller).
Palæmon cæmentarius Pœppig = *Bithynis cæmentarius* (Pœppig).
Palæmon dasydactylus Streets = *Macrobrachium mexicanum* (Saussure).
Palæmon faustinus Saussure = *Macrobrachium olfersii* (Wiegmann).
Palæmon forceps Milne Edwards = *Macrobrachium acanthurus* (Wiegmann).
Palæmon gaudichaudii Milne Edwards and Lucas = *Bithynis cæmentarius gaudichaudii* (Milne Edwards).
Palæmon jamaicensis Milne Edwards = *Macrobrachium jamaicense* (Herbst).
Palæmon lamarrei Milne Edwards = *Macrobrachium lamarrei* (Milne Edwards).
Palæmon mexicanus Saussure = *Macrobrachium mexicanum* (Saussure).
Palæmon nattereri Heller = *Macrobrachium nattereri* (Heller).
Palæmon olfersii Wiegmann = *Macrobrachium olfersii* (Wiegmann).
Palæmon punctatus Randall = *Macrobrachium jamaicense* (Herbst).
Palæmon sexdentatus Streets = *Macrobrachium mexicanum* (Saussure).
Palæmon gaudichaudii Milne Edwards = *Bithynis cæmentarius gaudichaudii* (Milne Edwards).
Palemon macrobrachion Herklots = *Macrobrachium acanthurus* (Wiegmann).
Palemon spinimanus Milne Edwards = *Macrobrachium olfersii* (Wiegmann).
Palinurus brevipes Pfeffer, part = *Panulirus ornatus* (Fabricius).
Palinurus fasciatus de Haan = *Panulirus ornatus* (Fabricius).
Palinurus frontalis Milne Edwards = *Palinustus frontalis* (Milne Edwards).
Palinurus inflatus Bouvier = *Panulirus ornatus* (Fabricius).
Palinurus martensii Nobili = *Panulirus ornatus* (Fabricius).
Palinurus ornatus Fabricius = *Panulirus ornatus* (Fabricius).
Palinurus pæssleri Pfeffer = *Panulirus ornatus* (Fabricius).
Panæus occidentalis Streets = *Peneus stylirostris* (Stimpson).
Panopeus affinis Streets and Kingsley = *Eurytium affine* (Streets and Kingsley).
Panopeus crenatus Milne Edwards and Lucas = *Eurypanopeus crenatus* (Milne Edwards and Lucas).
Panopeus planus Smith = *Eurypanopeus planus* (Smith).
Panopeus transversus Stimpson = *Eurypanopeus transversus* (Stimpson).
Panopeus validus Smith = *Panopeus chilensis* Milne Edwards and Lucas.
Panulirus gracilis Streets = *Panulirus ornatus* (Fabricius).
Panulirus polyphagus Ortmann, part = *Panulirus ornatus* (Fabricius).
Paralpheus spinifrons Bate = *Synalpheus spinifrons* (Milne Edwards).
Paraxanthus hirtipes Milne Edwards and Lucas = *Paraxanthus barbiger* (Pœppig).
Paraxanthus sexdecimdentatus Dana = *Cyclozanthops sexdecimdentatus* (Milne Edwards and Lucas).
Peltarion magellanicus Jacquinot and Lucas = *Hypopeltarium spinulosum* (White).
Peltarion spinulosum Dana = *Hypopeltarium spinulosum* (White).

- Penæus californiensis* Holmes = *Peneus brevirostris* Kingsley.
Pericera fossata Stimpson = *Macroceloma villosum* (Bell).
Pericera ovata Bell = *Stenocionops ovata* (Bell).
Pericera villosa Bell = *Macroceloma villosum* (Bell).
Petrolisthes agassizii Faxon = *Petrolisthes edwardsii* (Saussure).
Petrolisthes brasiliensis Smith = *Petrolisthes galathinus* (Bosc).
Petrolisthes danæ Kingsley = *Petrolisthes galathinus* (Bosc).
Petrolisthes edwardsius Lockington = *Petrolisthes edwardsii* (Saussure).
Petrolisthes marginatus Stimpson = *Petrolisthes armatus* (Gibbes).
Petrolisthes occidentalis Stimpson = *Petrolisthes galathinus* (Bosc).
Petrolisthes reissi Ortmann = *Petrolisthes angulosus* (Guérin).
Petrolisthes sexspinus Stimpson = *Petrolisthes galathinus* (Bosc).
Petrolisthes similis Stimpson = *Petrolisthes armatus* (Gibbes).
Petrolisthes validus Henderson = *Petrolisthes levigatus* (Guérin).
Phigaleia septemdentata White = *Trichodactylus* (*Dilocarcinus*) *orbicularis* (Meuschen).
Pilumnoides danai Kinahan = *Pilumnoides perlatus* (Pæppig).
Pilumnus lunatus Milne Edwards and Lucas = *Heteractæa lunata* (Milne Edwards and Lucas).
Pinnaxodes hirtipes Heller = *Pinnaxodes chilensis* (Milne Edwards).
Pinnixa panamensis Faxon = *Pinnixa transversalis* (Milne Edwards and Lucas).
Pinnotheres chilensis Milne Edwards = *Pinnaxodes chilensis* (Milne Edwards).
Pinnotheres transversalis Milne Edwards and Lucas = *Pinnixa transversalis* (Milne Edwards and Lucas).
Pisa aculeata Bell = *Microphrys aculeatus* (Bell).
Pisa spinipes Bell = *Mithrax spinipes* (Bell).
Pisoides cælatus Lockington = *Microphrys platysoma* (Stimpson).
Pisoides edwardsi Dana = *Pisoides tuberculosus* Milne Edwards and Lucas.
Plagusetes elatus Heller = *Acanthocyclus gayi* Milne Edwards and Lucas.
Plagusia capensis de Haan = *Plagusia chabrus* (Linnæus).
Plagusia clavimana Latreille = *Peronon planissimum* (Herbst).
Plagusia gaimardi Milne Edwards = *Plagusia chabrus* (Linnæus).
Plagusia orientalis Stimpson = *Plagusia tuberculata* Lamarck.
Plagusia serripes Lamarck = *Peronon planissimum* (Herbst).
Plagusia spinosa McLeay = *Peronon planissimum* (Herbst).
Plagusia squamosa Lamarck, not (Herbst) = *Plagusia tuberculata* Lamarck.
Plagusia tomentosa Milne Edwards = *Plagusia chabrus* (Linnæus).
Planes clypeatus Bowdich = *Planes minutus* (Linnæus).
Planes cyaneus Dana = *Planes minutus* (Linnæus).
Planes linnæana Bell = *Planes minutus* (Linnæus).
Platycarcinus dentatus Milne Edwards and Lucas, Nicolet = *Cancer polyodon* Pæppig.
Platycarcinus edwardsii Milne Edwards and Lucas, Nicolet = *Cancer edwardsii* Bell.
Platycarcinus irroratus Milne Edwards and Lucas, Nicolet, not Milne Edwards = *Cancer plebejus* Pæppig.
Platycarcinus longipes Milne Edwards and Lucas, Nicolet = *Cancer longipes* Bell.
Platyonichus bipustulatus Milne Edwards = *Ovalipes bipustulatus* (Milne Edwards).
Platyonichus purpureus Dana = *Ovalipes bipustulatus* (Milne Edwards).
Platypes edentata Lockington = *Thoe sulcata* Stimpson.
Porcellana acanthophora Milne Edwards and Lucas = *Petrolisthes acanthophorus* Milne Edwards and Lucas.
Porcellana affinis Guérin, not Gray = *Petrolisthes tuberculosus* (Milne Edwards).
Porcellana angulosa Guérin = *Petrolisthes angulosus* (Guérin).
Porcellana armata Gibbes = *Petrolisthes armatus* (Gibbes).
Porcellana boscii Dana = *Petrolisthes galathinus* (Bosc).
Porcellana carinata Kinahan = *Petrolisthes angulosus* (Guérin).

- Porcellana cristata* Milne Edwards = *Petrolisthes punctatus* (Guérin).
Porcellana danæ Gibbs = *Petrolisthes galathinus* (Bosc).
Porcellana desmarestii Eydoux and Gervais = *Petrolisthes* (?) *desmarestii* (Eydoux and Gervais).
Porcellana dubia Kinahan = *Petrolisthes acanthophorus* (Milne Edwards and Lucas).
Porcellana edwardsii Saussure = *Petrolisthes edwardsii* (Saussure).
Porcellana galathina Bosc = *Petrolisthes galathinus* (Bosc).
Porcellana granulosa Guérin = *Petrolisthes lævigatus* (Guérin).
Porcellana grossimana Guérin = *Pachycheles grossimanus* (Guérin).
Porcellana gundlachii Guérin = *Petrolisthes armatus* (Gibbs).
Porcellana lævigata Guérin = *Petrolisthes* (?) *lævigata* (Guérin).
Porcellana leporina Heller = *Petrolisthes armatus* (Gibbs).
Porcellana lobifrons Milne Edwards = *Petrolisthes tuberculatus* (Guérin).
Porcellana macrocheles Pöppig = *Petrolisthes violaceus* (Guérin).
Porcellana magnifica Gibbs = *Petrolisthes politus* (Gray).
Porcellana (*Pachycheles*) *crassa* A. Milne Edwards = either *Pachycheles grossimanus* (Guérin) or *Pachycheles mexicanus* Streets.
Porcellana patagonica Cunningham = *Petrolisthes patagonicus* (Cunningham).
Porcellana polita Gray = *Petrolisthes politus* (Gray).
Porcellana punctata Dana, not Guérin = *Petrolisthes angulosus* (Guérin).
Porcellana setispinosa Gibbs = *Petrolisthes galathinus* (Bosc).
Porcellana spinifrons Milne Edwards = *Petrolisthes spinifrons* (Milne Edwards).
Porcellana striata Milne Edwards = *Petrolisthes granulatus* (Guérin).
Porcellana tuberculata Guérin = *Petrolisthes tuberculatus* (Guérin).
Porcellana tuberculifrons Milne Edwards and Lucas, part = *Petrolisthes tuberculatus* (Guérin).
Porcellana tuberculifrons Milne Edwards and Lucas, part = *Petrolisthes tuberculosus* (Milne Edwards).
Porcellana tuberculosa Milne Edwards = *Petrolisthes tuberculosus* (Milne Edwards).
Porcellana valida Dana = *Petrolisthes lævigatus* (Guérin).
Porcellana violacea Guérin = *Petrolisthes violaceus* (Guérin).
Potamia chilensis Milne Edwards and Lucas = *Pseudothelphusa chilensis* (Milne Edwards and Lucas).
Potamia dentata Latreille = *Pseudothelphusa dentata* (Latreille).
Potamocarcinus equatorialis Doflein = *Pseudothelphusa macropa* (Milne Edwards).
Potamocarcinus dentatus Ortmann = *Pseudothelphusa dentata* (Latreille).
Potamocarcinus macropus Ortmann = *Pseudothelphusa macropa* (Milne Edwards).
Potamocarcinus planus Ortmann = *Pseudothelphusa plana* (Smith).
Potamocarcinus principessæ Doflein = *Pseudothelphusa macropa* (Milne Edwards).
Potamocarcinus reflexifrons Ortmann = *Pseudothelphusa reflexifrons* (Ortmann).
Prionoplax spinicarpus Stimpson, not Milne Edwards = *Prionoplax ciliata* Smith.
Pseudiriphia hispida A. Milne Edwards = *Eriphides hispida* (Stimpson).
Pseudocorystes armatus Milne Edwards = *Pseudocorystes sicarius* (Pöppig).
Pseudothelphusa dentata Ortmann, part = *Pseudothelphusa macropa* (Milne Edwards).
Pseudothelphusa tenuipes Pocock = *Pseudothelphusa dentata* (Latreille).
Pseudothelphusa dentata Ortmann, part = *Pseudothelphusa plana* Smith.
Pseudothelphusa gracilipes Nobili = *Pseudothelphusa nobilii* Rathbun.
Pseudothelphusa macropa Miers, part = *Pseudothelphusa ecuadorensis* Rathbun.
Pseudothelphusa macropa, var. *plana* (?) Miers = *Pseudothelphusa lindigiana* Rathbun.
Quadrrella nitida Smith = *Quadrrella coronata* Dana.
Rhodia pyriformis Bell = *Herbatia pyriformis* (Bell).
Sesarma barbata Krauss = *Cyclograpsus punctatus* Milne Edwards.
Sesarma pisonii Milne Edwards = *Sesarma pisoni* (Milne Edwards).
Solenolambrus typicus Cano, not Stimpson = ? *Solenolambrus arcuatus* Stimpson.

- Squilla aculeata* Bigelow = *Chloridella aculeata* (Bigelow).
Squilla armata Milne Edwards = *Chloridella armata* (Milne Edwards).
Squilla ceratii Guérin = *Pseudosquilla lessonii* (Guérin).
Squilla dubia Milne Edwards = *Chloridella dubia* (Milne Edwards).
Squilla lessonii Guérin = *Pseudosquilla lessonii* (Guérin).
Squilla monoceros Milne Edwards = *Pseudosquilla lessonii* (Guérin).
Squilla nepa Nicolet, not Latreille = ? *Chloridella aculeata* (Bigelow).
Squilla parva Bigelow = *Chloridella parva* Bigelow.
Squilla spinifrons Owen = *Pseudosquilla lessonii* (Guérin).
Sylviocarcinus devillei Moreira = *Trichodactylus* (*Valdivia*) *peruvianus* (A. Milne Edwards).
Sylviocarcinus peruvianus A. Milne Edwards = *Trichodactylus* (*Valdivia*) *peruvianus* (A. Milne Edwards).
Synalpheus neptunus Lenz. See Coutière, Proc. U. S. Nat. Mus., vol. 36, 1909, p. 10.
Telphusa dentata Latreille = *Pseudothelphusa dentata* (Latreille).
Telphusa (?) *quadrata* Latreille = *Trichodactylus* (*Trichodactylus*) *fluvialis* (Latreille).
Thalassina maxima Hess = *Thalassina anomala* (Herbst).
Thalassina scorpionides Latreille = *Thalassina anomala* (Herbst).
Thelphusa chilensis Heller = *Potamon* (*Geothelphusa*) *chilensis* (Heller).
Thoë edentata (Lockington), Cano = *Thoë sulcata* Stimpson.
Thoë erosa A. Milne Edwards, not Bell = *Thoë panamensis* Nobili.
Trapezia formosa Smith = *Trapezia digitalis* Latreille.
Trapezia leucodactyla Rüppell = *Trapezia digitalis* Latreille.
Trichodactylus cunninghami A. Milne Edwards = *Trichodactylus* (*Trichodactylus*) *fluvialis* (Latreille).
Trichodactylus granarius Nicolet = *Hemigrapsus crenulatus* (Milne Edwards).
Trichodactylus granulatus Milne Edwards = *Hemigrapsus crenulatus* (Milne Edwards).
Trichodactylus punctatus Eydoux and Souleyet = *Trichodactylus* (*Trichodactylus*) *fluvialis* (Latreille).
Trichodactylus quadrata Milne Edwards = *Trichodactylus* (*Trichodactylus*) *fluvialis* (Latreille).
Uca cunninghami Bate = *Trichodactylus* (*Trichodactylus*) *fluvialis* (Latreille).
Uca gibbosa Holmes = *Uca stenodactylus* (Milne Edwards and Lucas).
Uca laevis Milne Edwards = *Ucides occidentalis* (Ortmann).
Uca platydactyla Ortmann, part = *Uca princeps* (Smith).
Uca platydactyla, var. *stylifera* Ortmann, part = *Uca stylifera* (Milne Edwards).
Uca una Milne Edwards and Lucas = *Ucides occidentalis* (Ortmann).
Uca vocator Ortmann, part = *Uca brevifrons* (Stimpson).
Xantho bifrons Ortmann = *Xantho gaudichaudii* Milne Edwards.
Xantho denticulata Stimpson, not *X. denticulatus* White = *Cycloxanthops* (?) *stimpsoni* (A. Milne Edwards).
Xantho grandimanus Lockington = *Ozius verreauxii* Saussure.
Xantho multidentatus Lockington = *Cycloxanthops* (?) *stimpsoni* (A. Milne Edwards).
Xantho orbigny Milne Edwards and Lucas = *Platyzanthus orbigny* (Milne Edwards and Lucas).
Xantho planus Milne Edwards = *Homalaspis plana* (Milne Edwards).
Xantho sexdecimdentatus Milne Edwards and Lucas = *Cycloxanthops sexdecimdentatus* (Milne Edwards and Lucas).
Xantho vittata Stimpson = *Cycloxanthops vittatus* (Stimpson).
Xanthodes xantusii Stimpson = *Xanthias xantusii* (Stimpson).

EXPLANATION OF PLATES.

PLATE 36.

- Fig. 1.—*Inachoides microrhynchus*, nat. size. After Milne Edwards and Lucas.
 2.—*Epialtus marginatus*, male, $\times \frac{1}{2}$. After Bell.

PLATE 37.

- Fig. 1.—*Hepatus chiliensis*, $\times \frac{1}{2}$. After Milne Edwards and Lucas.
 2.—*Arenurus mexicanus*, male, nat. size. After A. Milne Edwards.

PLATE 38.

- Fig. 1.—*Cancer plebejus*, much reduced. After Bell.
 2.—*Cancer polyodon*, much reduced. After Bell.

PLATE 39.

- Fig. 1.—*Xantho gaudichaudii*, nat. size. After Milne Edwards and Lucas.
 2.—*Platyxanthus crenulatus*, nat. size. After A. Milne Edwards.

PLATE 40.

- Fig. 1.—*Cycloxanthops sexdecimdentatus*, nat. size. After Milne Edwards and Lucas.
 2.—*Platyxanthus orbigny*, $\times \frac{1}{2}$. After Milne Edwards and Lucas.

PLATE 41.

- Fig. 1.—*Eriphia squamata*, male, $\times \frac{1}{2}$. After A. Milne Edwards.
 2.—*Panopeus purpureus*, female, $\times \frac{1}{2}$. After A. Milne Edwards.
 3.—*Petrolisthes armatus*, reduced. After Guérin.
 4.—*Panopeus chilensis*, $\times \frac{1}{2}$. After Milne Edwards and Lucas.

PLATE 42.

- Fig. 1.—*Grapsus grapsus*, $\times \frac{1}{2}$. After Milne Edwards.
 2.—*Ucides occidentalis*, male, $\times \frac{1}{2}$. After Milne Edwards.

PLATE 43.

- Fig. 1.—*Uca insignis*, female, nat. size. After Milne Edwards.
 2.—*Ocypode gaudichaudii*, nat. size. After Milne Edwards and Lucas.
 3.—*Ostracotheres politus*, female, $\times 2$. After Lenz.

PLATE 44.

Cardisoma crassum, male, $\times \frac{1}{2}$, La Paz.

PLATE 45.

- Fig. 1.—*Leucosilia jurinei*, $\times \frac{1}{2}$. After Bell.
 2.—*Leptograpsus variegatus*, $\times \frac{1}{2}$. After Dana.
 3.—*Callianassa uncinata*, $\times \frac{1}{10}$. After Milne Edwards.
 4.—*Microphrys aculeatus*, female. After Bell.

PLATE 46.

- Fig. 1.—*Pinnixa transversalis*, nat. size. After Milne Edwards and Lucas.
 2.—*Teleophrys cristulipes*, male, $\times 2$. After Stimpson.
 3.—*Pachygrapsus transversus*, $\times \frac{1}{2}$. After Dana.
 4.—*Acanthonyx petiverii*, nat. size. After Milne Edwards and Lucas.
 5.—*Pachycheles grossimanus*, nat. size. After Guérin.
 6.—*Uca galapagensis*, male, $\times 1\frac{1}{2}$. a, inner side of large claw; b, dorsal view.

PLATE 47.

- Fig. 1.—*Eurytium tristani*, male, $\times \frac{1}{10}$.
 2.—*Hypoconcha peruviana*, female, $\times 2$.
 3.—*Goniopsis pulchra*, female, $\times \frac{1}{10}$.
 4.—*Clibanarius panamensis*, $\times 2$.

PLATE 48.

- Fig. 1.—*Pagurus benedicti*, $\times 1\frac{1}{2}$, San Luis Gonzales Bay.
 2.—*Speocarcinus ostrearicola*, male, $\times 1\frac{1}{2}$.
 3.—*Uca princeps*, male, nat. size, Abreojos Point.
 4.—*Dromidia sarraburei*, female, nat. size.
 5.—*Petrolisthes spinifrons*, $\times 1\frac{1}{2}$.
 6.—*Dissodactylus nitidus*, female, $\times 2\frac{1}{2}$, Albatross Station 2835.

PLATE 49.

- Fig. 1.—*Emerita analoga*, nat. size.
 2.—*Dardanus sinistripes*, nat. size, Magdalena Bay.
 3.—*Dardanus imbricatus*, $\times 1\frac{1}{2}$.
 4.—*Portunus (Portunus) acuminatus*, male, $\times 1\frac{1}{2}$, Panama Bay.
 5.—*Eupleurodon trifurcatus*, female, $\times 2\frac{1}{2}$.
 6.—*Emerita emerita*, nat. size.

PLATE 50.

- Fig. 1.—*Paguristes tomentosus*, $\times 2\frac{1}{2}$.
 2.—*Pilumnoides perlatus*, male, $\times 2$.
 3.—*Microphrys platysoma*, male, $\times 1\frac{1}{2}$, Lower California, L. Dignet.
 4.—*Aratus pisoni*, $\times \frac{5}{8}$. After Milne Edwards.
 5.—*Hepatella amica*, female, $\times 2\frac{1}{2}$.

PLATE 51.

- Fig. 1.—*Macrobrachium jamaicense*, $\times \frac{3}{10}$. After Bate.
 2.—*Paguristes hirtus*. After Dana. *a*, anterior part of animal, $\times 2$; *b*, part of inner antennæ; *c*, hand; *d*, part of leg of second or third pair; *e*, part of leg of fourth pair; *f*, of fifth pair.
 3.—*Pinnotherelia levigata*, nat. size. After Milne Edwards and Lucas.

PLATE 52.

- Fig. 1.—*Panulirus ornatus*, much reduced. After de Haan.
 2.—*Rhynchocinetes typus*, $\times \frac{1}{10}$. After Milne Edwards and Lucas.
 3.—*Pseudosquilla lessonii*, $\times \frac{1}{2}$. After Guérin.

PLATE 53.

- Fig. 1.—*Palamon ritteri*, $\times 2\frac{1}{2}$.
 2.—*Peneus stylirostris*, $\times 1\frac{1}{2}$.
 3.—*Lysiosquilla decemspinosa*, $\times 2\frac{1}{2}$.
 4.—*Synalpheus townsendi peruvianus*, $\times 2\frac{1}{2}$.
 5.—*Munida cokeri*, $\times 1\frac{1}{2}$.

PLATE 54.

- Fig. 1.—*Bithynis camentarius gaudichaudii*, $\times \frac{1}{2}$.
 2.—*Peneus brevirostris*, nat. size, Guaymas.
 3.—*Chloridella dubia*, $\times \frac{3}{4}$.

PLATE 55.

- Callinectes toxotes*, female, $\times \frac{3}{4}$.

PLATE 56.

- Callinectes arcuatus*, male, $\times \frac{3}{4}$.

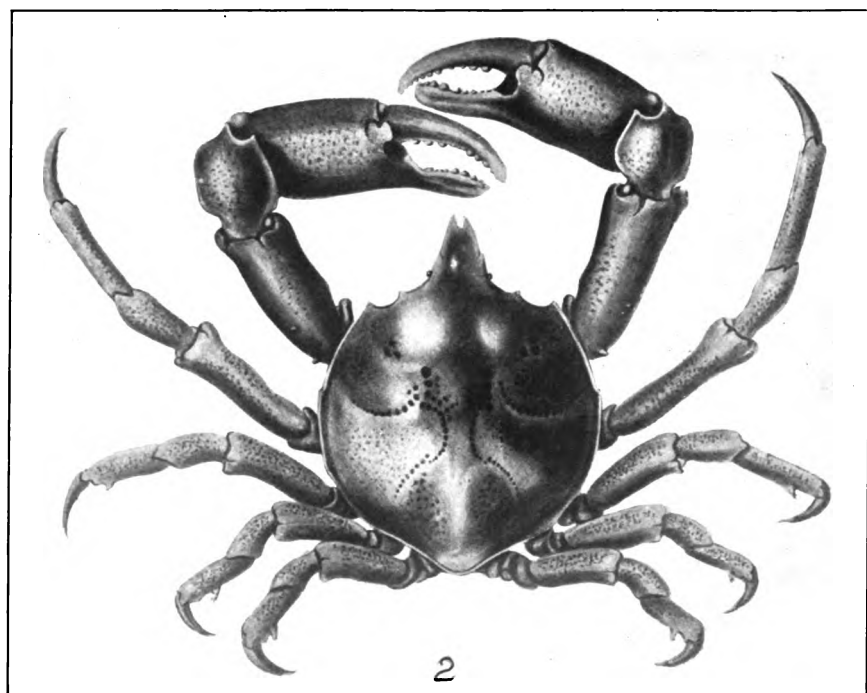
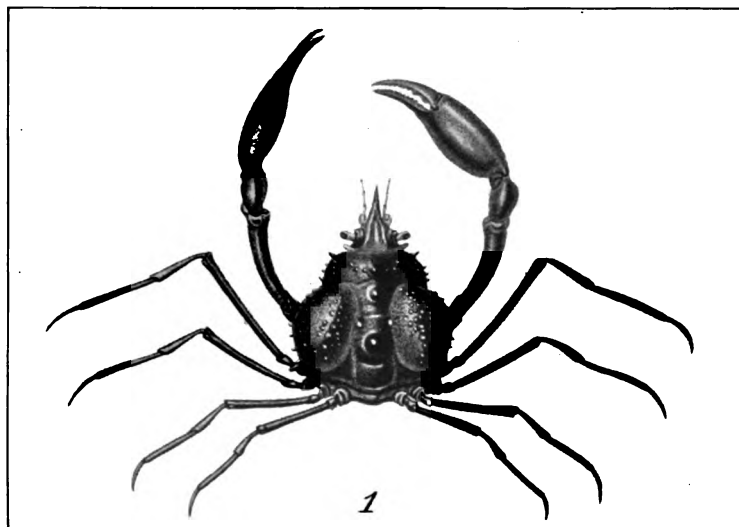


FIG. 1.—*INACHOIDES MICRORHYNCHUS*.

FIG. 2.—*EPIPLATIS MARGINATUS*.

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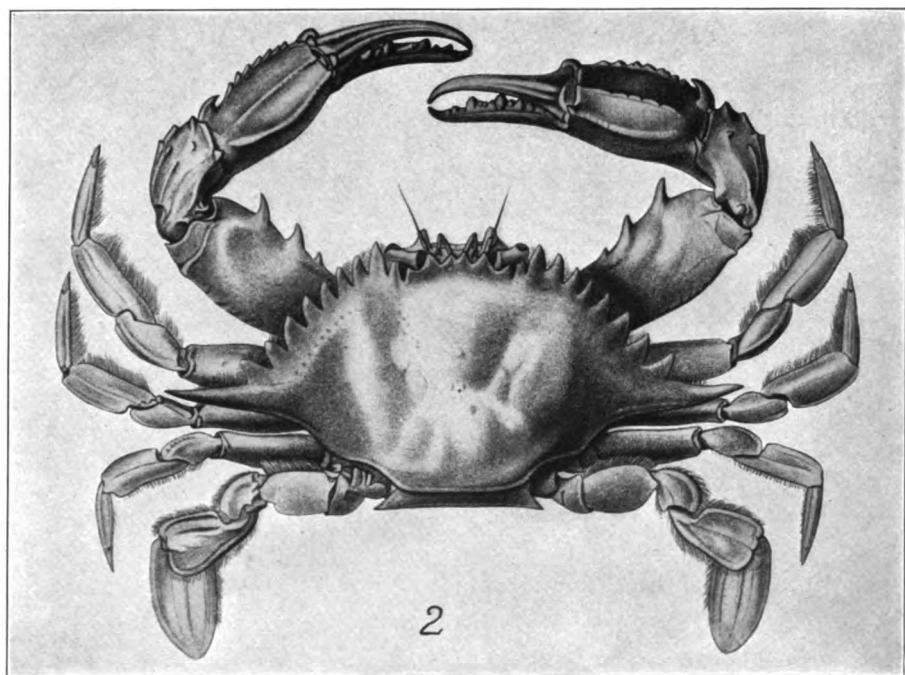
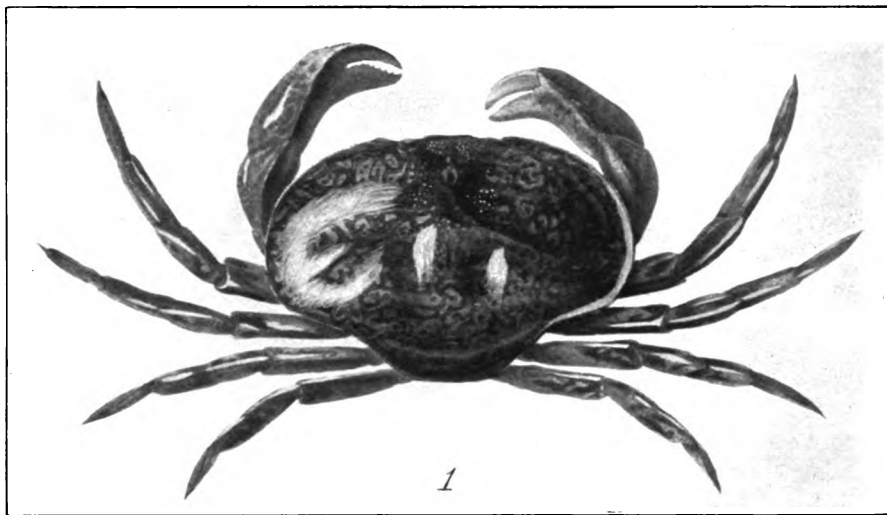


FIG. 1.—*HEPATUS CHILIENSIS*.
FIG. 2.—*ARENÆUS MEXICANUS*.

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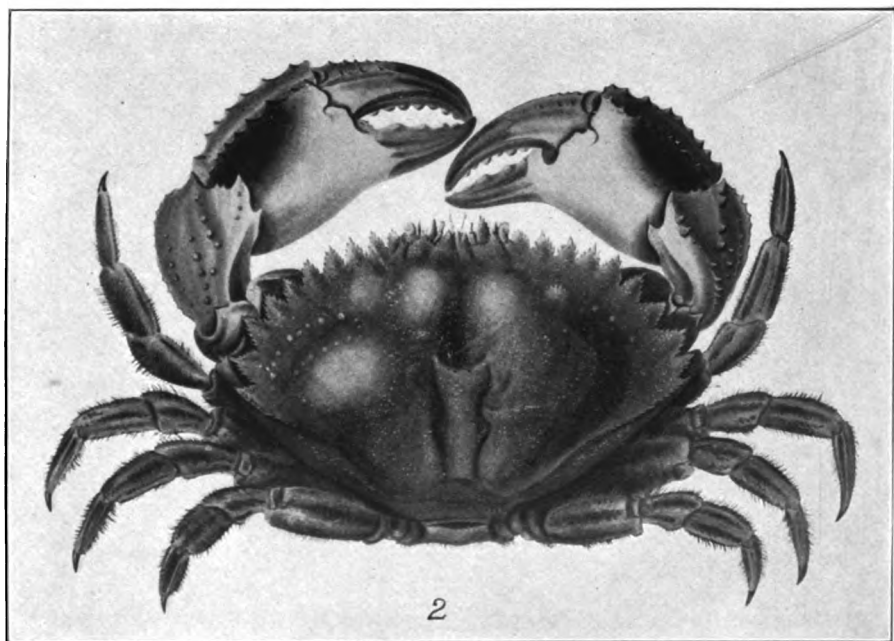
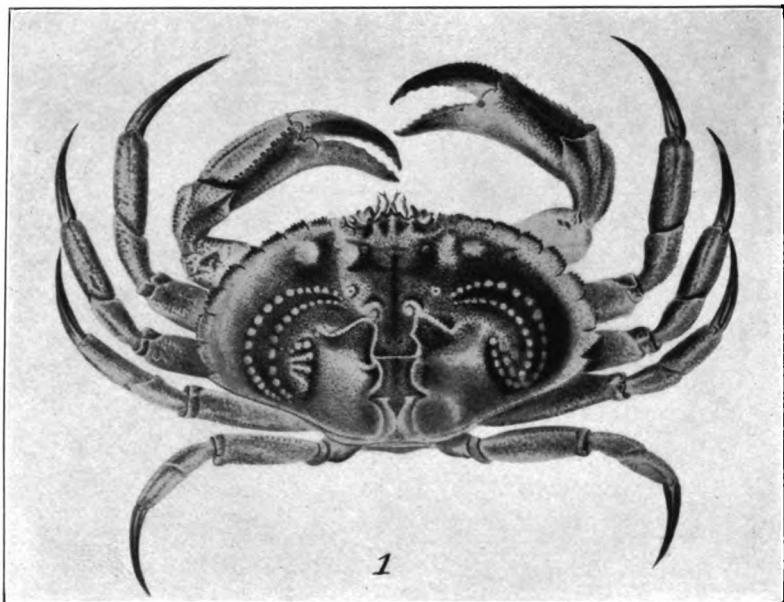


FIG. 1.—*CANCER PLEBEJUS*.

FIG. 2.—*CANCER POLYODON*.

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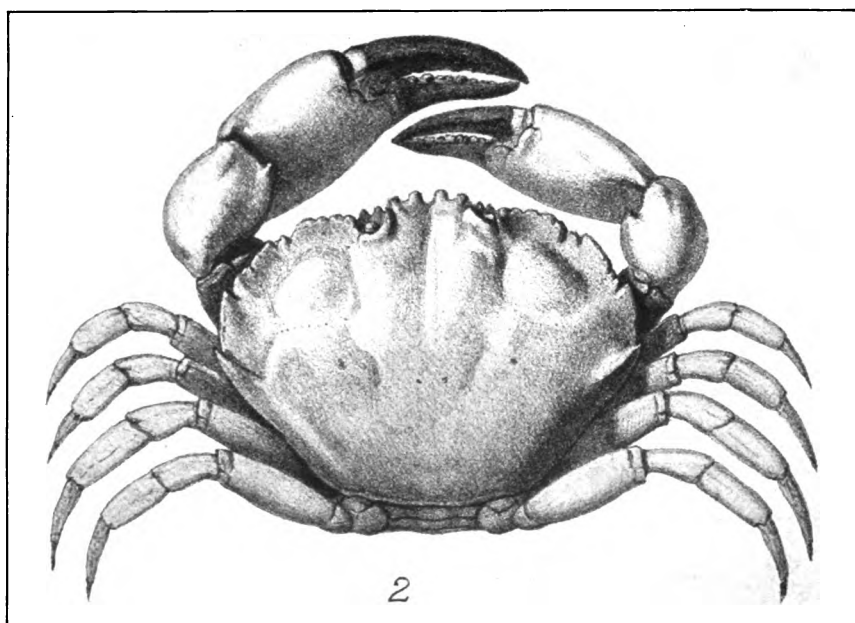
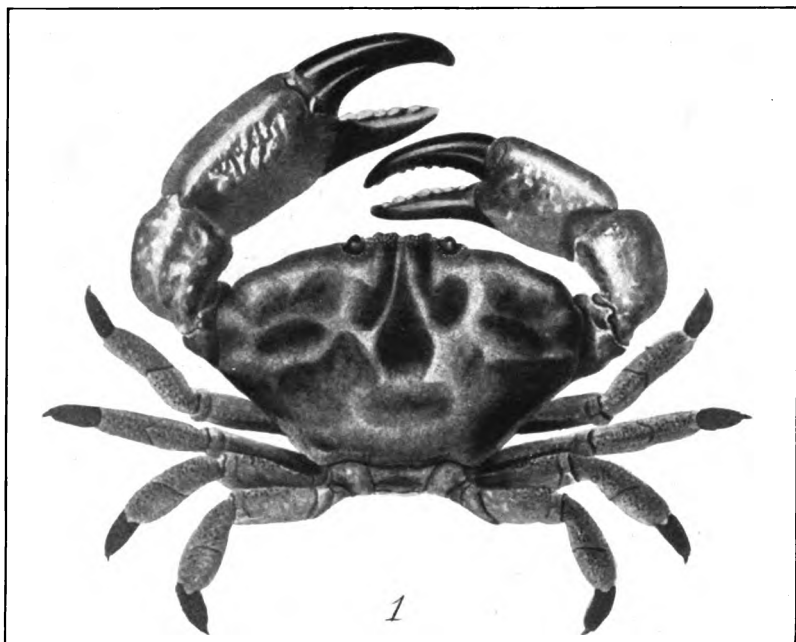


FIG. 1.—*XANTHO GAUDICHAUDII*.
FIG. 2.—*PLATYXANTHUS CRENULATUS*.

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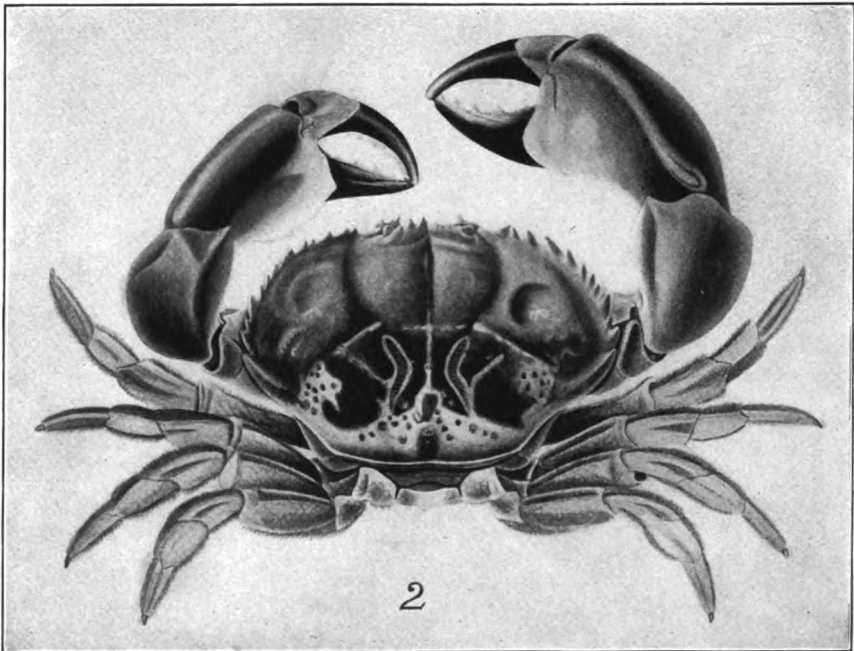
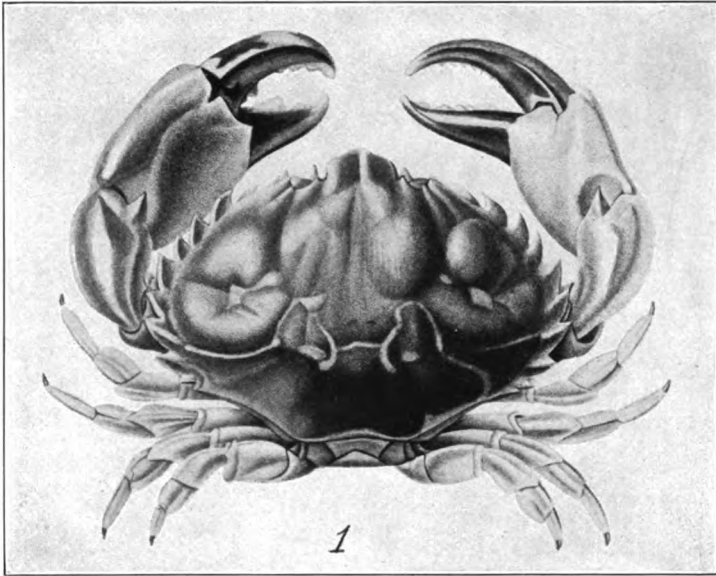


FIG. 1.—CYCLOXANTHOPS SEXDECIMDENTATUS.
FIG. 2.—PLATYXANTHUS ORBIGNYI.

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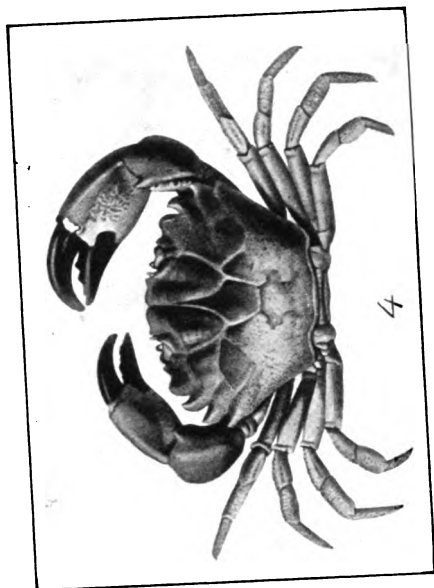
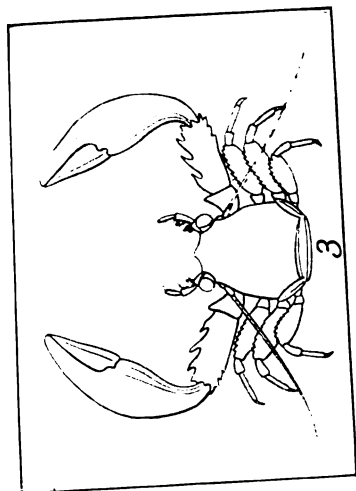


FIG. 2.—*PANOPEUS PURPUREUS*.
FIG. 4.—*PANOPEUS CHILENSIS*.

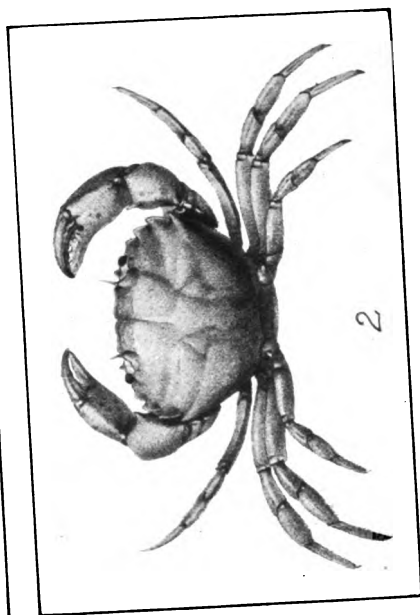
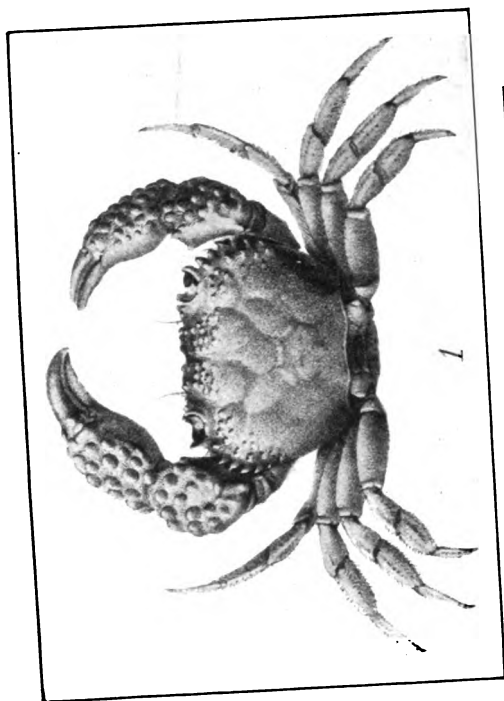


FIG. 1.—*ERIPHIA SQUAMATA*.
FIG. 3.—*PETROLISTHES ARMATUS*.

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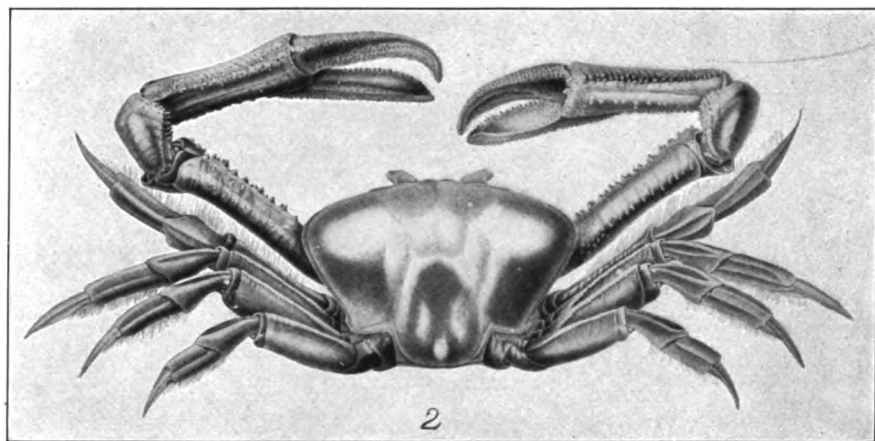
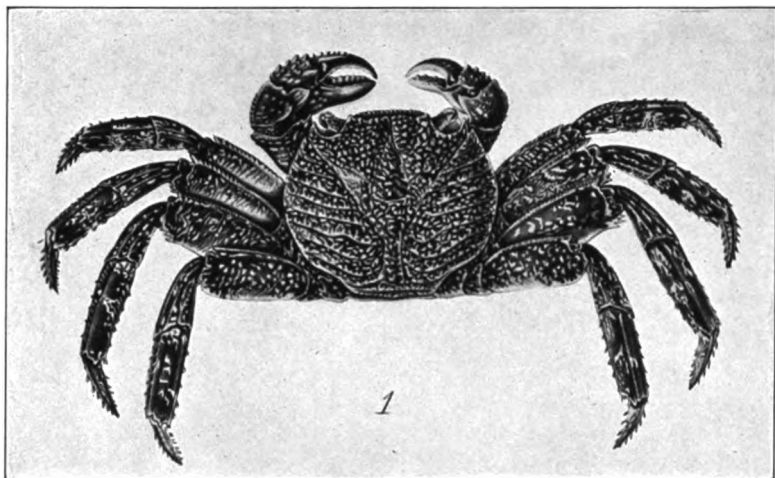


FIG. 1.—GRAPSUS GRAPSUS.

FIG. 2.—UCIDUS OCCIDENTALIS.

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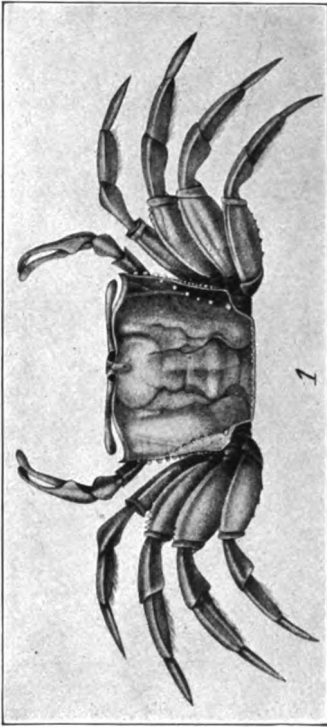


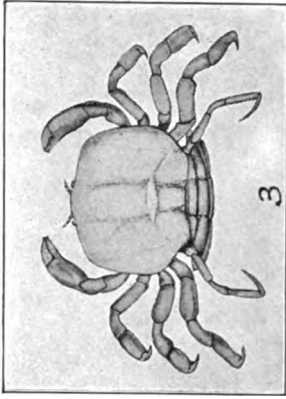
FIG. 1.—*Uca insignis*.

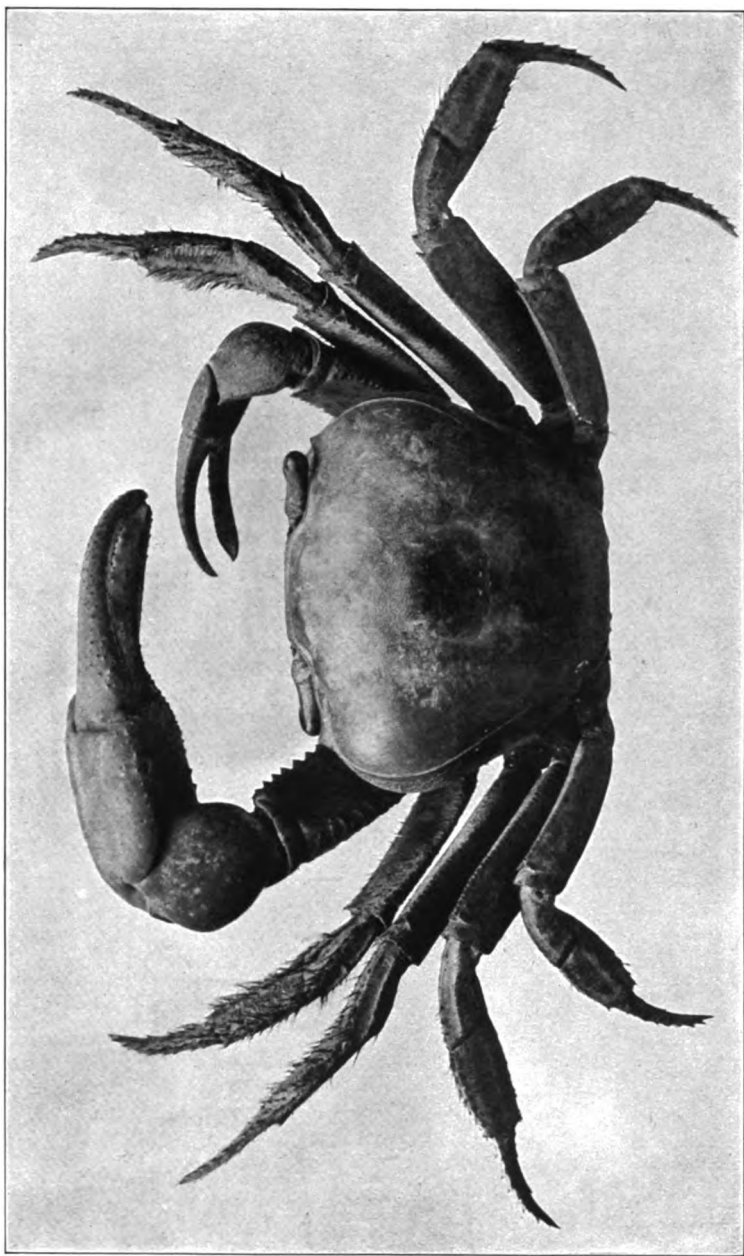
FIG. 2.—*Ocypode gaudichaudii*.

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FIG. 3.—*Ostracotheres politus*.





CARDISOMA CRASSUM.

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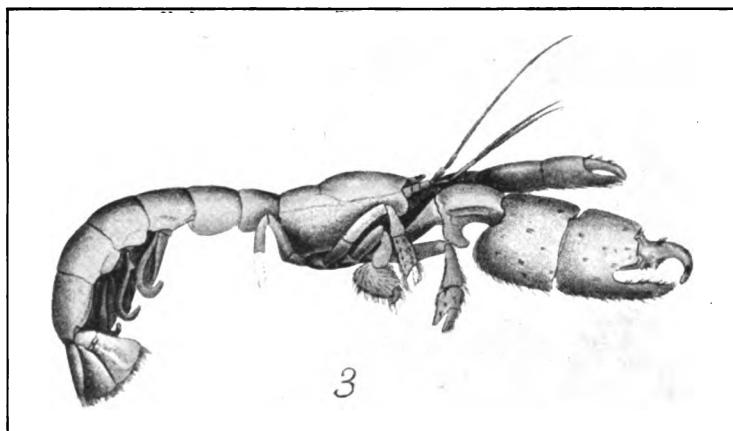
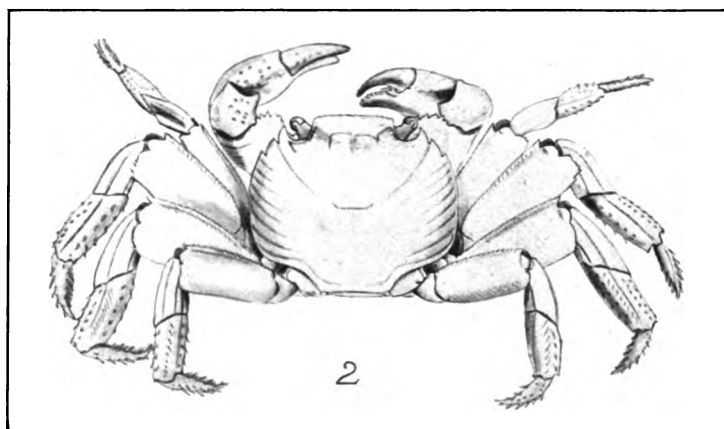


FIG. 1.—*LEUCOSILIA JURINEI*.
FIG. 3.—*CALLIANASSA UNCINATA*.

FIG. 2.—*LEPTOGRAPSUS VARIEGATUS*.
FIG. 4.—*MICROPHRYS ACULEATUS*.

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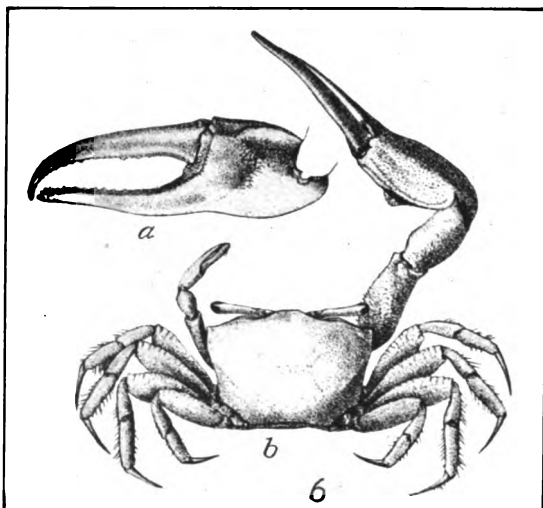
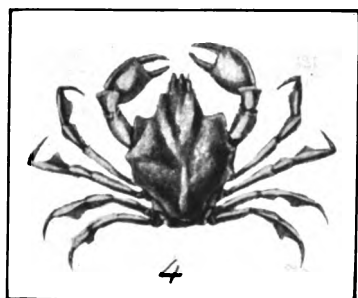
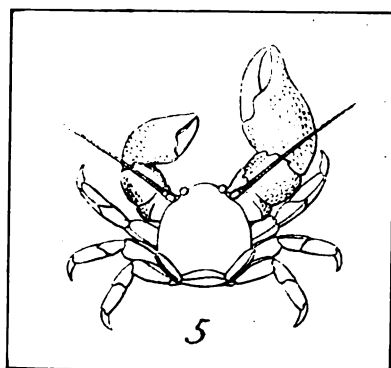
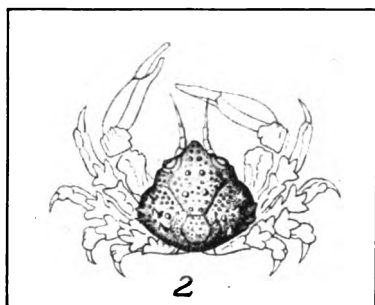
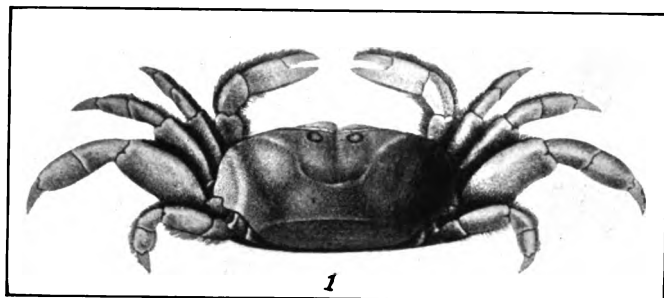


FIG. 1.—PINNIXA TRANSVERSALIS.

FIG. 3.—PACHYGRAPSUS TRANSVERSUS.

FIG. 5.—PACHYCHELES GROSSIMANUS.

FIG. 2.—TELEOPHYRS CRISTULIPES.

FIG. 4.—ACANTHONYX PETIVERII.

FIG. 6.—UCA GALAPAGENSIS.

FOR EXPLANATION OF PLATE SEE PAGE 619.

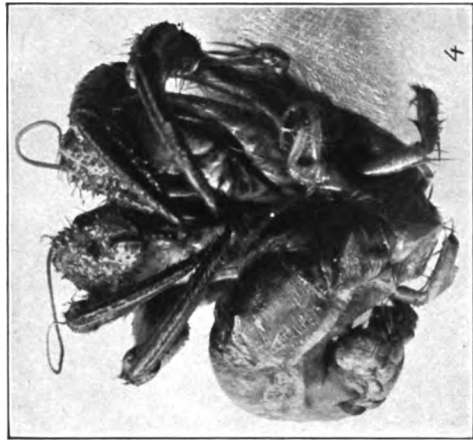
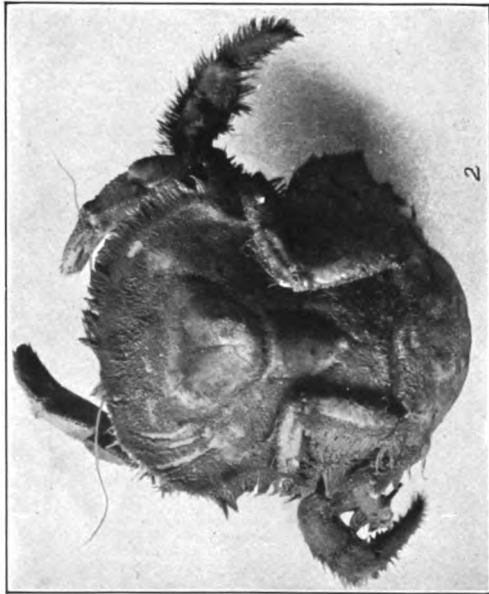


FIG. 1.—*EURYTIUM TRISTANI*.
FIG. 3.—*GONIOPSIS PULCHRA*.

FIG. 2.—*HYPOCONCHA PERUVIANA*.
FIG. 4.—*CLIBANARIUS PANAMENSIS*.

FOR EXPLANATION OF PLATE SEE PAGE 620.

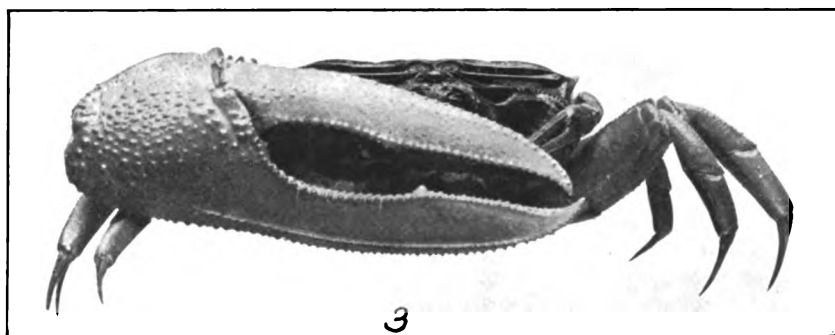
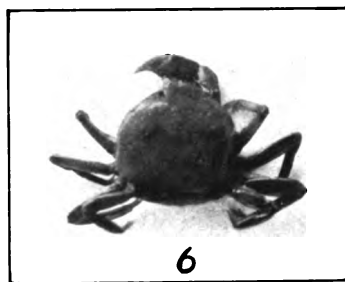
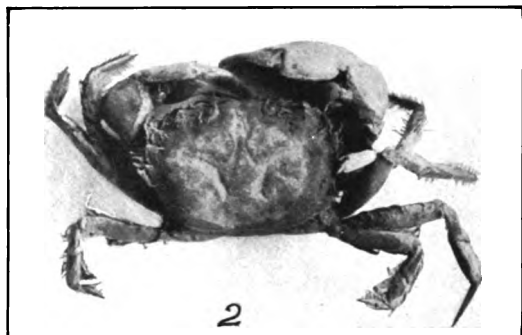
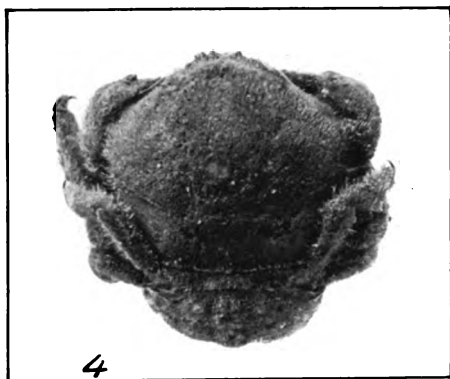
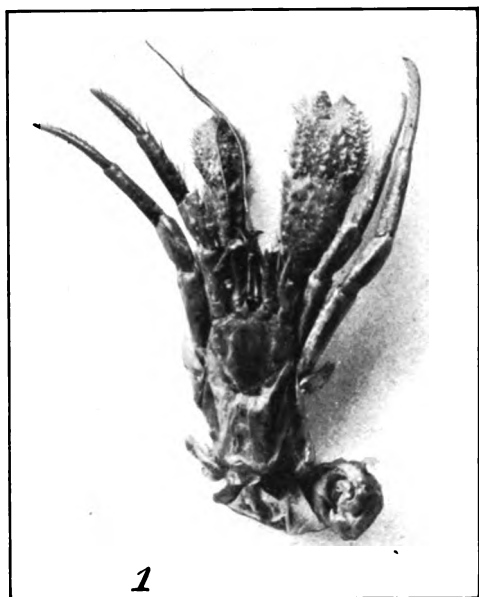


FIG. 1.—*PAGURUS BENEDICTI*.

FIG. 3.—*UCA PRINCEPS*.

FIG. 5.—*PETROLISTHES SPINIFRONS*.

FIG. 2.—*SPEOCARCINUS OSTREARICOLA*.

FIG. 4.—*DROMIDIA SARRABUREI*.

FIG. 6.—*DISSODACTYLUS NITIDUS*.

FOR EXPLANATION OF PLATE SEE PAGE 620.



FIG. 1.—*EMERITA ANALOGA*.

FIG. 3.—*DARDANUS IMBRICATUS*.

FIG. 5.—*EUPLEURODON TRIFURCATUS*.

FIG. 2.—*DARDANUS SINISTRIPES*.

FIG. 4.—*PORTUNUS (PORTUNUS) ACUMINATUS*.

FIG. 6.—*EMERITA EMERITA*.

FOR EXPLANATION OF PLATE SEE PAGE 620.

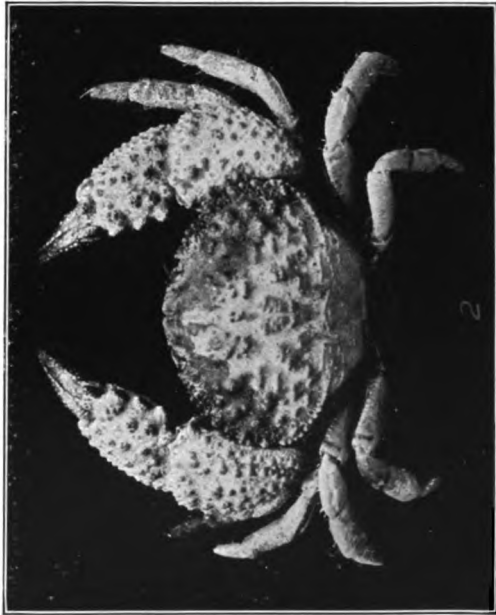
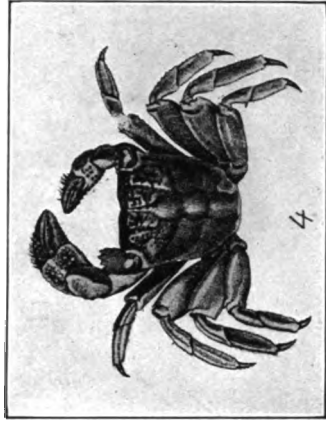
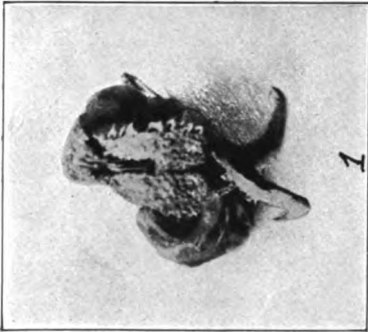


FIG. 1.—*PAGURISTES TOMENTOSUS*.

FIG. 2.—*PILUMNOIDES PERLATUS*.

FIG. 3.—*MICROPHRYS PLATYSOMA*.

FIG. 4.—*ARATUS PISONI*.

FIG. 5.—*HEPATELLA AMICA*.

FOR EXPLANATION OF PLATE SEE PAGE 620.

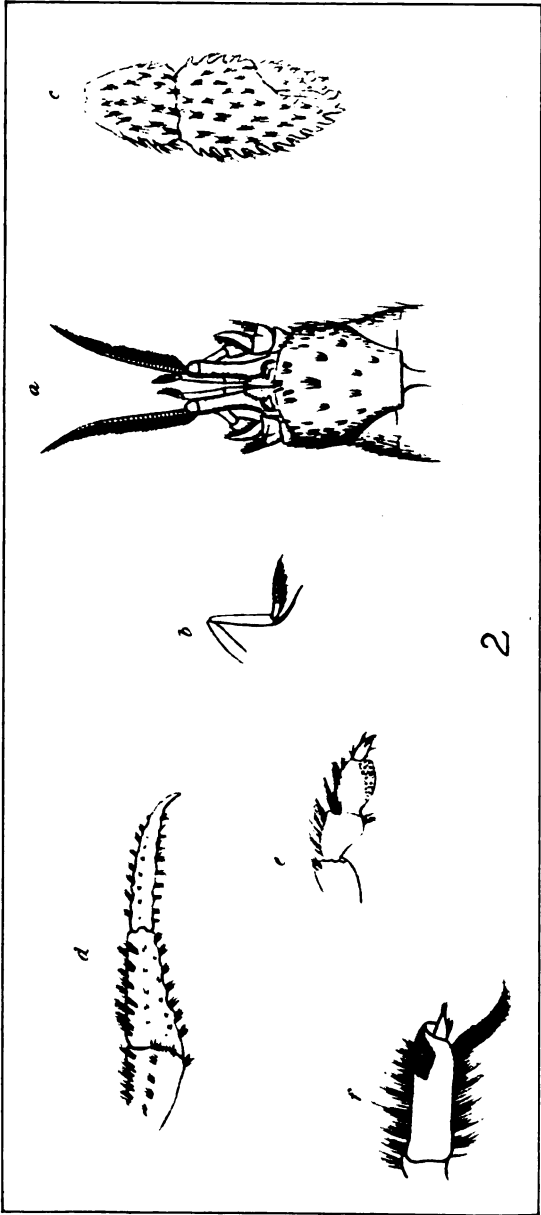
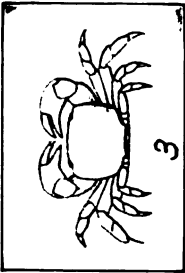


FIG. 1.—MACROBRACHIUM JAMAICENSE.

FIG. 2.—PAGURISTES HIRTUS.

FIG. 3.—PINNOTHERELIA LEVIGATA.

FOR EXPLANATION OF PLATE SEE PAGE 620.

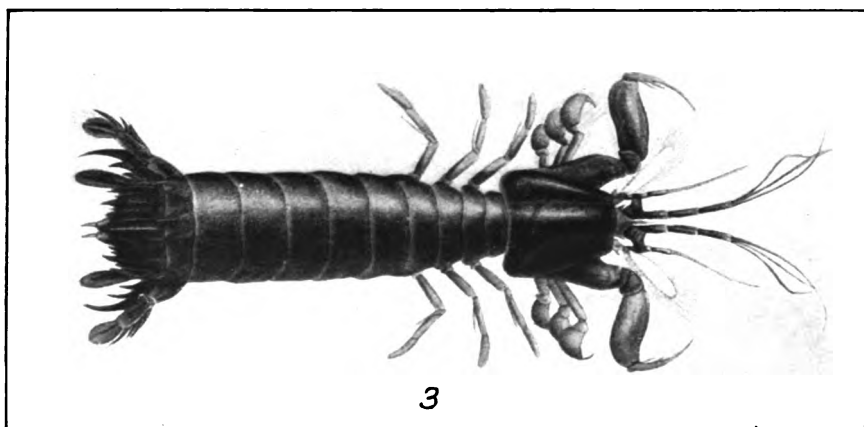
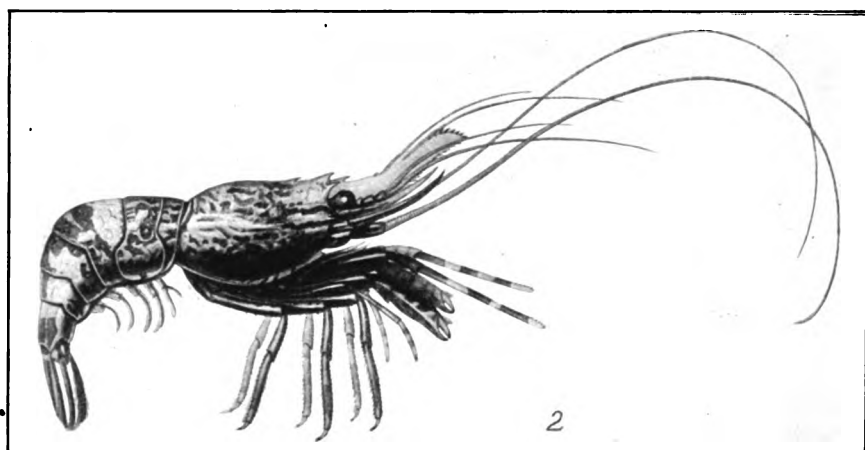
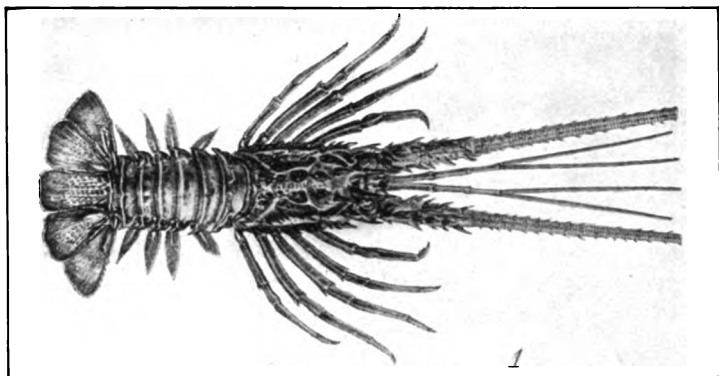


FIG. 1.—*PANULIRUS ORNATUS*.
FIG. 2.—*RHYNCHOCINETES TYPUS*.
FIG. 3.—*PSEUDOSQUILLA LESSONII*.

FOR EXPLANATION OF PLATE SEE PAGE 620.

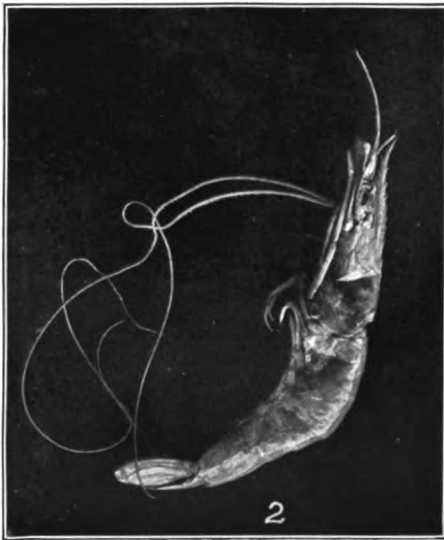
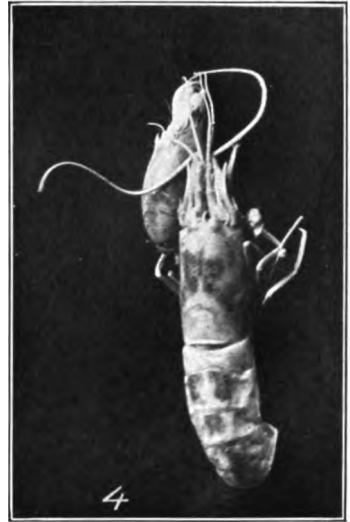


FIG. 1.—PALÆMON RITTERI.

FIG. 3.—LYSIOSQUILLA DECEMSPINOSA.

FIG. 2.—PENEUS STYLIROSTRIS.

FIG. 4.—SYNALPHEUS TOWNSENDI PERUVIANUS.

FIG. 5.—MUNIDA COKERI.

FOR EXPLANATION OF PLATE SEE PAGE 620.

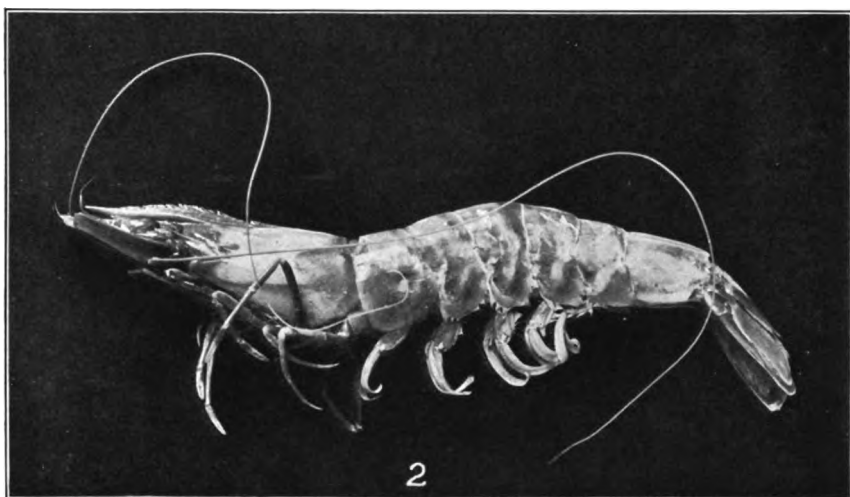
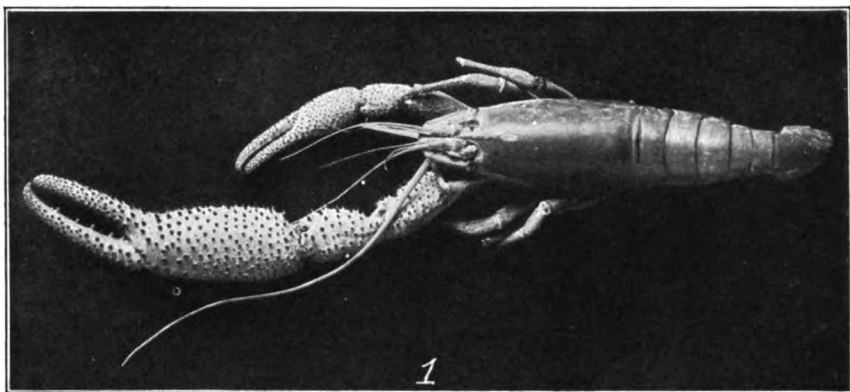
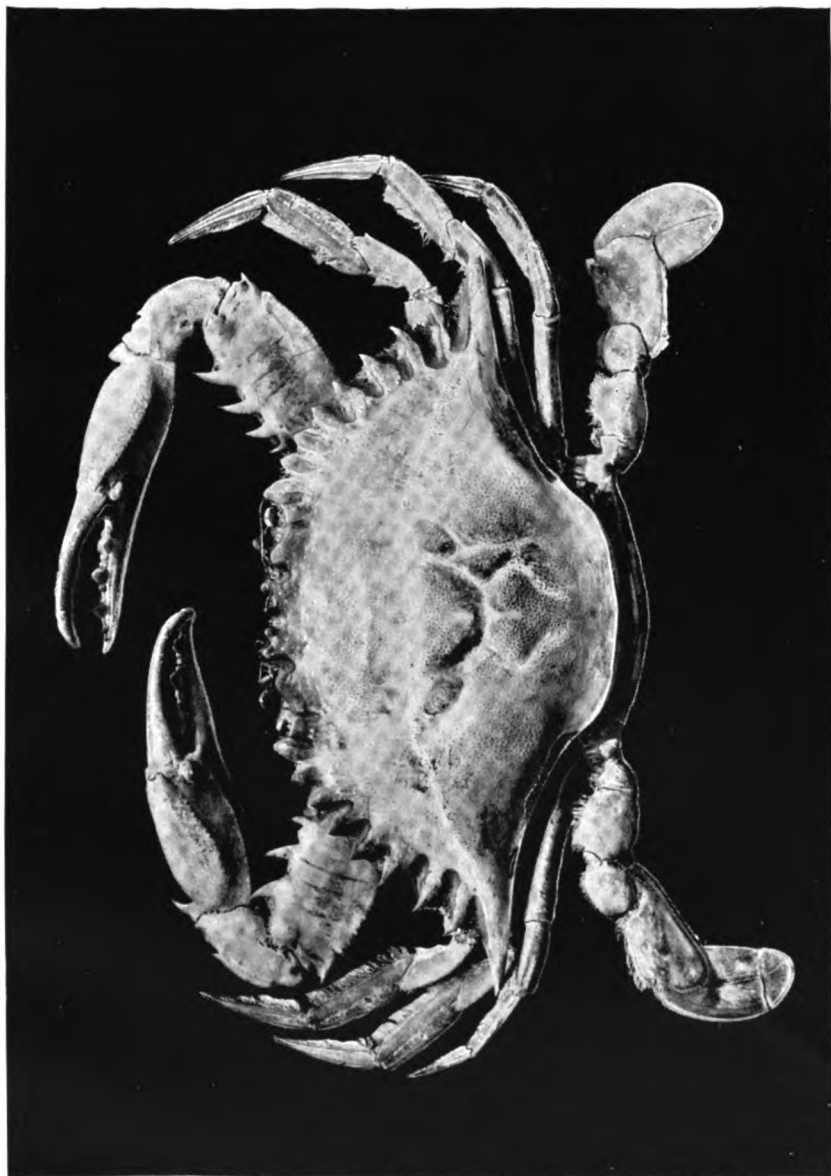


FIG. 1.—*BITHYNIS CÆMENTARIUS* GAUDICHAUDII.

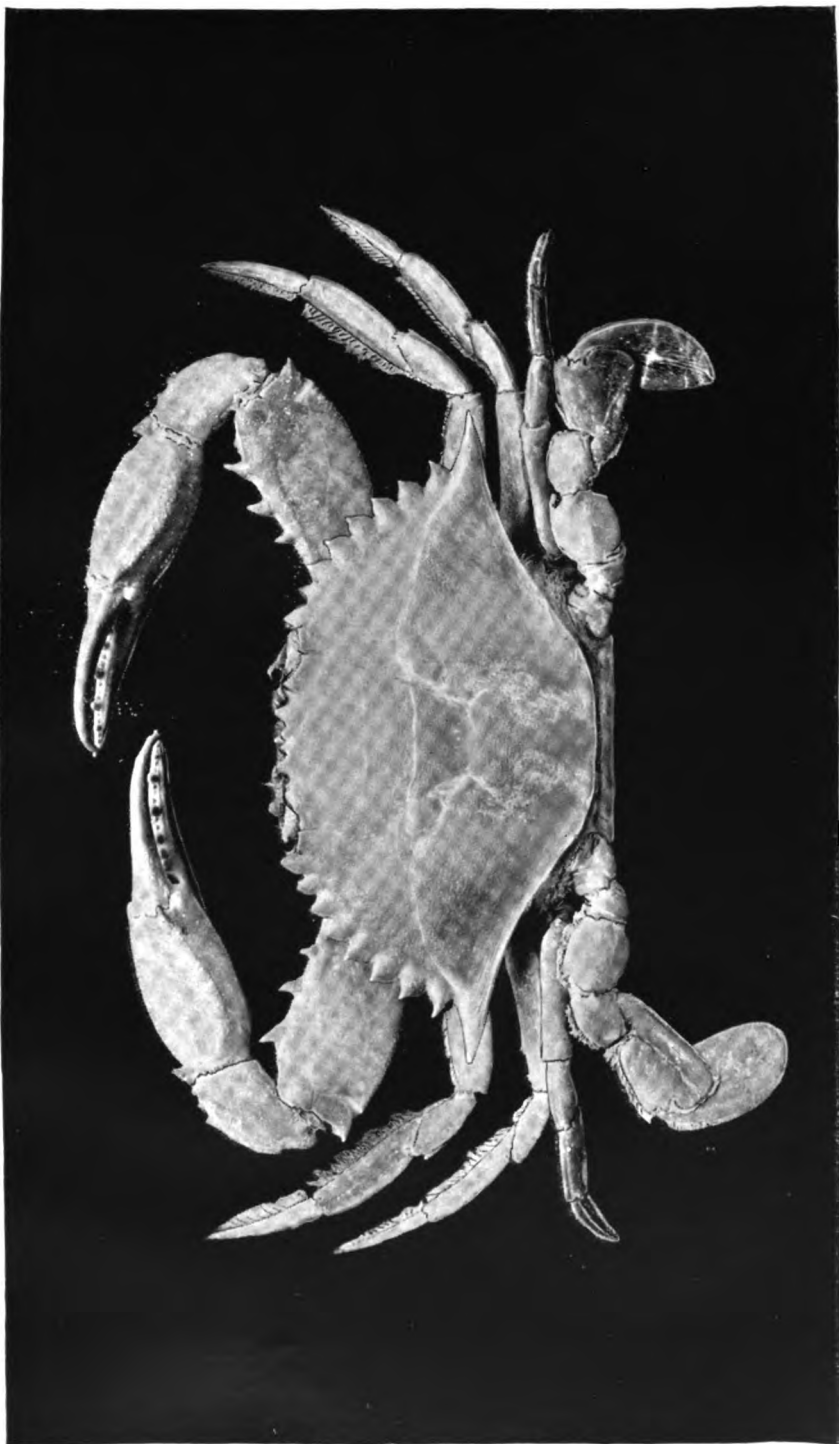
FIG. 2.—*PENEUS BREVIROSTRIS*.

FIG. 3.—*CHLORIDELLA DUBIA*.

FOR EXPLANATION OF PLATE SEE PAGE 620.



CALLINECTES TOXOTES.
FOR EXPLANATION OF PLATE SEE PAGE 620.



CALLINECTES ARCUATUS.

FOR EXPLANATION OF PLATE SEE PAGE 620.

MARINE AMPHIPODS FROM PERU.

By ALFRED O. WALKER,
Of Maidstone, Kent, England.

The Amphipoda from Chincha Islands are all of one species to which I have given the name *Stenothoe assimilis* Chevreux,^a with which species it agrees except in having more spines on the telson and third uropods. From *S. gallensis* Walker^b it differs in the last joint of the third uropods of the male, which in my species is upturned, serrate and blunt, while in the Peruvian specimens and in *S. assimilis* it is straight, smooth, and sharply pointed.

Both these species are so closely allied to *S. valida* Dana, 1852, that but for the fact that he has figured the third peræopods with a wide basal joint instead of the narrow one of the above two species, they might both be referred to it, notwithstanding the trifling difference in the third uropods. I have a strong suspicion that if Dana's type-specimen could be discovered, it would be found that he had overlooked the difference in the form of the joints. *S. assimilis* would then be a synonym of *S. valida*.^c

STENOTHOË ASSIMILIS Chevreux.

Abundant in hydroid colonies on bottoms of "lanchas" (lighters used in embarking guano).

DESCRIPTION OF THE SPECIES BY CHEVREUX (TRANSLATION).

Male.—Body rather stout, 5 mm. long, in the position figured. Head without rostrum; lateral lobes not prominent, rounded. Coxal plates of second pair subtriangular, anterior margin very convex, inferior margin concave. Coxal plates of third pair larger than those of fourth pair. Posterior angles of epimeral plates of last segment of metasome a little produced backward, hardly acute.

Eyes of medium size, round, containing a very large number of ocelli.

Superior antennæ equal in length to sum of head and first four segments of mesosome; first article of peduncle nearly as long as head, much longer than second article; third article very short, not quite so long as first article of flagellum; the latter much longer than peduncle and composed of fifteen articles. The inferior antennæ surpass somewhat the superior; flagellum much shorter than last two articles of peduncle and containing ten articles.

^a Bull. de l'Institut Océanographique, no. 113, Mars 1908, p. 4, figs. 4-6.

^b Amph. of Pearl Oyster Fisheries, 1904, p. 261, pl. 111, fig. 19.

^c See Ann. Mag. Nat. Hist., ser. 8, vol. 6, 1910, pp. 31-32.

Palp of anterior maxillæ with a row of spines along inner margin of second segment; outer lobe armed with six large spines. Posterior maxillæ with only a rudiment of an inner lobe, armed with three small spines; outer lobe bears ten spines on distal margin. Inner lobe of maxillipeds reaches a third the length of the contiguous article.

Anterior gnathopods remarkable for the size of their meral article, which is almost twice as long as carpus and is prolonged to extremity of the latter; propodus oval, much longer than carpus, and nearly twice as long as wide; its palmar borders separated from the posterior border by a group of small spines upon which the extremity of the dactyl can rest; distal part of inner border of dactyl bears a small tooth.

Posterior gnathopods well developed; basal article recurved rather strongly in distal part; three following articles very short; propodus oval, more than twice as long as wide, anterior border a regular curve; posterior border, fused with palmar border, has a straight portion, finely ciliated, ending, near articulation of dactyl, in a long, sharp, curved tooth, followed by a deep, narrow cut; dactylus as long as propodus, abruptly bent near its base, finely ciliated on the greater part of its inner border, which has a slight emargination near the tip.

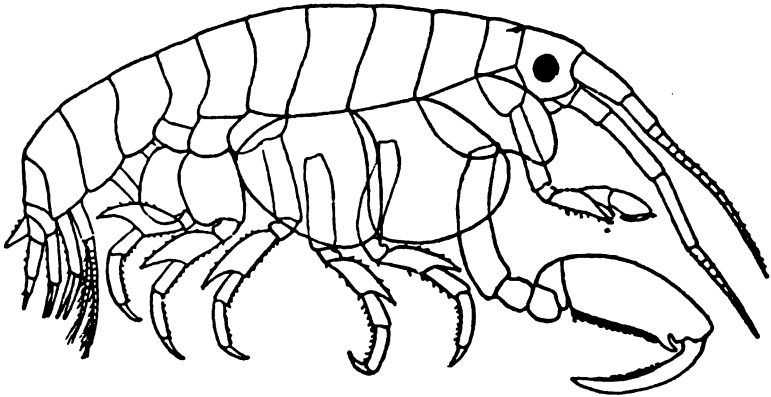


FIG. 1.—*STENOTHOE ASSIMILIS*, MALE $\times 15$. AFTER CHEVREUX.

In the pereopods of the first two pairs, the merus is produced forward to form a sharp lobe; propodus much longer than carpus.

Basal article of pereopods of third pair narrow, anterior and posterior margins parallel; merus similar to, but larger than, that of preceding pereopods.

Basal article of pereopods of two last pairs strongly dilated behind, nearly as wide as long in fourth pair, and notably wider than long in fifth pair; merus prolonged nearly to end of carpus. Pereopods of fifth pair shorter than the preceding.

Extremities of three pairs of uropods reach nearly the same line. Peduncle of uropods of last pair much longer than branch; first article of branch not quite so long as last one.

Telson subtriangular, a little longer than wide, bearing three pairs of large lateral spines.

Female.—Antennæ a little shorter than in male. Anterior gnathopods differ little; nevertheless, in the female the merus is less developed and is not nearly twice as long as carpus. Posterior gnathopods almost as large as in male but differ in the propodus a little shorter, and the palmar margin bearing only one short, straight tooth and no deep cut; dactyls regularly curved.

FRESH-WATER AMPHIPODS FROM PERU.

By ADA L. WECKEL.

Oak Park High School, Oak Park, Illinois.

The single species of fresh-water Amphipod was taken in vast abundance at Lake Titicaca, July 30, 1908, underneath small rocks along shore of Isla Blanca (near Puno).

HYALELLA KNICKERBOCKERI (Bate).

Allorchestes knickerbockeri BATE, Cat. Amph. Crust. Brit. Mus., 1862, p. 36, pl. 6.
Hyalella knickerbockeri WECKEL, Proc. U. S. Nat. Mus., vol. 32, 1907, p. 54, text fig. 15, and synonymy.

Eyes round or nearly so; interspace slightly greater than their diameter. First antennæ shorter than second; first two segments of peduncle about equal, slightly longer than third; flagellum about twice as long as peduncle and composed of seven to nine segments; second antennæ about half as long as body; peduncle exceeding that of first pair, the two distal segments elongated and nearly equal; flagellum usually but little longer than in first pair, composed of eight to fifteen segments.

First gnathopods in male more than half as broad as long; lateral margins strongly curved and furnished with minute spinules; palm transverse, concave at middle, provided with a few small teeth and short hairs at posterior angle and a tuft of long stiff hairs at anterior one; dactyl strongly curved, shorter than palm. First gnathopods in female closely resemble those in male.

Second gnathopods of male much longer than first ones; carpus not longer than broad, a long, narrow lobe along posterior margin of propodus; propodus stout, more than half as broad as long, much broadened distally, especially in mature specimens; anterior margin convex; posterior one straight, oblique, and unarmed; palm oblique, middle portion slightly arcuate, with a notch near middle and one or two slight emarginations at posterior angle; provided with a sub-marginal row of spines; palm in immature specimens transverse, emarginations very slight, dactyl not so strongly curved as in adult.

Second gnathopods of female slender and weak; carpus and propodus elongated and much narrower than in male; carpus more than twice as long as broad, posterior projection proportionally not so great as in male; propodus more than twice as long as broad; palm forming less than a right angle with posterior margin, furnished with fewer submarginal spines than in male; dactyl not strongly curved and fitting palm closely.

Posterior margins of coxal plates of third, fourth, and fifth peræopods serrate.

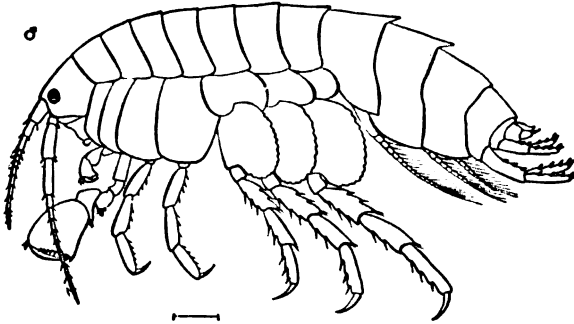


FIG. 1.—HYALELLA KNICKERBOCKERI, MALE $\times 12$. MADISON, WISCONSIN. AFTER SMITH.

Postero-lateral angles of first two abdominal segments slightly produced, forming less than a right angle; first two or three segments usually produced dorsally, forming a well-marked median posterior tooth. Telson short, entire, as broad as long, furnished distally with a slender seta at each side.

First uropods almost twice as long as second pair; third pair very short, not exceeding basal segment of second pair in length; peduncle short, nearly as broad as long, furnished distally with a few hairs; the single ramus slender, tapering, about equal in length to peduncle and provided with a few slender setæ at tip.

A REVISION OF THE FOSSIL PLANTS OF THE GENERA ACROSTICHOPTERIS, TÆNIOPTERIS, NILSONIA, AND SAPINDOPSIS FROM THE POTOMAC GROUP.

By EDWARD W. BERRY,

Of the Johns Hopkins University, Baltimore.

The present paper is the second of a series of revisions of the more important genera of fossil plants from the Potomac group in Maryland and Virginia. The first dealt with the genus *Nageiopsis* and formed No. 1738 of the present volume of the Proceedings. The material upon which these studies are based is nearly all contained in the U. S. National Museum collections, but the collections of the Johns Hopkins University and the Maryland Geological Survey have also been utilized.

The following pages are devoted to the genera *Acrostichopteris*, *Tæniopteris*, *Nilsonia*, and *Sapindopsis*. Of these the fern genus *Acrostichopteris* and the dicotyledonous genus *Sapindopsis* were founded upon collections from the Potomac strata to which they are largely confined. The fern genus *Tæniopteris* and the cycad genus *Nilsonia* have not been previously recognized in the Lower Cretaceous of eastern North America, the specimens upon which the present determinations are based having been previously wrongly correlated with the genera *Angiopteridium*, *Anomozamites*, and *Platypterigium*.

THE GENUS ACROSTICHOPTERIS OF FONTAINE.

This genus is characterized as follows by its describer:

Fronds probably creeping, with very long, often flexuous rachises, which seem to have been more or less succulent; pinnae going off obliquely, long and apparently slender; ultimate pinnae or pinnules subopposite to alternate, comparatively short, and cut down nearly to the rachis into more or less cuneate-flabellate pinnules or primary segments. These are divided generally into cuneate-flabellate segments, which in turn are separated into oblong segments ending in oblong, or ovate-obtuse, or acute teeth; pinnules decurrent and forming a wing; nerves slender but distinct, flabellately diverging, forking dichotomously, and ending in the teeth; fructification occurring on the basal segments of the pinnules, in the upper portions of the frond on the upper one alone, in the lower portions on the upper and lower ones, the fructified segments close appressed to the principal rachis. The fructified segments are so modified as to take the

form of leathery, rounded, or elliptical segments, which on the lower side are covered by the naked sori, and seen from the upper side, especially when compressed on the clay, look like pods.^a

The fructification characters should be modified to include those of *Acrostichopteris pluripartita*, which appear to represent entire pinnules reduced to fertile segments and not merely basal lobes of otherwise sterile pinnules thus transformed, as appears to be the case in *Acrostichopteris longipennis*.

With all the collected material at hand it is difficult to see any conclusive evidence that the species included in this genus were creeping in habit or had succulent rachises or that the fertile segments were covered with naked sori. There is some evidence as to fructification characters, but this is most indefinite as regards details, and it may be noted that what are called nut-like seeds when applied to fragments referred by this author to his genus *Baieropsis* are described as above for fragments which he referred to the present genus, although neither the fertile nor the vegetative parts are distinguishable with certainty in these two supposed genera.

All of the species which constituted the genus *Baieropsis* of Fontaine, except *Baieropsis expansa* and *Baieropsis macrophylla* are referred to *Acrostichopteris* in the present paper, with which they are obviously allied in instances where they are not actually identical. They present no characters which are clearly those of the order Ginkgoales except their subdivided fronds, which are suggestive of *Baiera* or *Jeanpaulia*, but might equally suggest various living Polypodiaceæ, as, for instance, *Actinopteris* and *Rhipidopteris* or the various species of *Schizæa* of the family Schizæaceæ. Among fossil species they are very similar to forms referred to *Sphenopteris*, *Palmatopteris*, etc. Considerations which point away from *Baiera* in the direction of the ferns are the fine inequilateral outline of the leaves (pinnules), their decurrence, and their arrangement in a pinnate manner in a single plane. The two species *Baieropsis expansa* and *macrophylla* furnish fructified specimens which clearly indicate their reference to the family Schizæaceæ. These will be fully discussed in another place.

With regard to the botanical position of *Acrostichopteris* little is known. According to Fontaine:

The genus in the naked sori is like *Polypodium*, but in most features stands nearest to *Acrostichum*, much resembling the section *Rhipidopteris*. In this latter, however, the fructification is borne on separate pinnules. If we place the fructified pinnules of *Rhipidopteris* as basal segments on the sterile ones, we have a form strikingly like *Acrostichopteris*. This genus has also some resemblance to *Marsilea*.

Seward^b on the strength of Fontaine's conclusions as quoted above places the genus in the Polypodiaceæ, and the present writer in the

^a Monogr. U. S. Geol. Surv., No. 15, 1890, p. 106.

^b Seward, Wealden Flora, pt. 1, 1894, p. 60.

absence of better data has followed the same course, although the definite reference of the two species of *Baieropsis* above mentioned to the Schizæaceæ throws doubt upon all the other similar forms. Potonié^a places the genus as a synonym of his *Palmatopteris* in the artificial group of *Sphenopterides*.

Acrostichopteris may be compared with the modern *Actinopteris*, a monotypic genus of the Indoafrican steppes, with the neotropical genus *Rhipidopteris*, or with *Schizæa dichotoma* Swartz., and *Schizæa elegans* Swartz, of the family Schizæaceæ. It is not closely related to *Acrostichophyllum* Velenovsky (1889) of the Cenomanien of Bohemia. As here delimited it is purely a form genus embracing five species in the Maryland-Virginia region. Of these, two species are confined to the basal beds or Patuxent formation, two species range through the whole Lower Cretaceous of this region and are present as well in both the Lakota and Fuson formations of the Black Hills region, and one species is confined to the Patapsco formation and is widespread in its occurrence. One additional species, suggestive of *Acrostichopteris parvifolia* of the Patuxent and likewise close to the only remaining species, *Acrostichopteris ruffordi* Seward^b of the English Wealden, has recently been described by Knowlton^c from the Kootenai of Montana. Considering for a moment the Portuguese homotaxial deposits we find a considerable number of remarkably similar forms described by Saporta^d, all of which are referred to the form-genus *Sphenopteris*. Thus from the Upper Jurassic there is *Sphenopteris tenellisecta* Saporta, from the Urgonien *S. cuneifida* Saporta, from the Aptien *S. flabellisecta* Saporta, *S. tenuifissa* Saporta, and *S. debilior* Saporta. These forms are certainly congeneric with *Acrostichopteris* and with more representative material doubtless some species would be found to be common to both sides of the Atlantic. Some are more nearly like the forms segregated by Fontaine to form his genus *Baieropsis*, while others are of the type which this author referred to *Acrostichopteris*.

ACROSTICHOPTERIS LONGIPENNIS Fontaine emend.

Acrostichopteris longipennis FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 107, pl. 170, fig. 10; pl. 171, figs. 1, 5, 7.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, p. 557.

Acrostichopteris densifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890 (part), pl. 170, fig. 11; pl. 171, figs. 2, 6; pl. 172, fig. 13 (not pl. 94, fig. 4, which is referable to *A. parvifolia* Fontaine).

Acrostichopteris parvifolia FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, p. 558, pl. 116, fig. 5.

^a Potonié in Engler and Prantl, 1902, p. 490.

^b Seward, Wealden Flora, pt. 1, 1894, p. 61, pl. 6, fig. 3.

^c Knowlton, Smiths. Misc. Coll., vol. 50, 1907, p. 110, pl. 9, figs. 3, 3a.

^d Saporta, Flora Foss. Portugal, 1894, pp. 25, 69, 127, 160, 161.

Baieropsis foliosa FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 209, pl. 93, figs. 4-6.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 481, 482, 489, 504, 508, pl. 110, fig. 9.

Baieropsis denticulata angustifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 210, pl. 112, fig. 7.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, p. 491.

Description.—Fronds with relatively long pinnæ, decompose proximad and becoming simpler distad, the ultimate pinnules subopposite to alternate, rather close set. Pinnules inequilateral and slightly decurrent, cut into several narrow sublinear divisions and terminated by two or more subacute teeth. The lower pinnules are wider and more lacinate and more decidedly alternate on the stout rachis. Venation fine, but distinct, flabellate and dichotomous, ultimate divisions terminating in the apical teeth. The sterile and smaller specimens tend to much greater density than those of larger size or those showing traces of fructifications. The fructifications, which are illy defined in the coarse matrix, are borne on the proximal or distal or both basal segments of the pinnules; the segment or segments involved become wider and shorter and elliptical in outline. No details can be made out.

This species is exceedingly common in the Patapsco formation to which it is confined, being especially common in the beds of this age at Federal Hill, to which locality it is largely confined in the Maryland area. In Virginia it occurs at a large number of localities within this formation.

It is difficult to see upon what evidence, unless it be the supposed relation with the modern *Rhipidopteris*, led Fontaine to claim a creeping habit for these forms. The rachis is sometimes more or less flexuous but not markedly so, and the length is relatively great. Proximally, however, the rachis becomes stouter with decompose pinnæ as broad or broader than they are long. It seems probable that this form was not a ground dweller with creeping rachis or rhizome nor did it adhere to tree trunks, but reclined or clambered over the abundant erect Lower Cretaceous vegetation as does the modern *Lygodium*. It appears to be closely related to *Sphenopteris debilior* Saporta^a of the Albién of Portugal.

Occurrence.—PATAPSCO FORMATION. Near Wellhams, Federal Hill, Maryland. Near Brooke, 72d milepost, Hell Hole, Mouth of Hell Hole?, White House Bluff, Dumfries Landing, Aquia Creek cut, and Mount Vernon, Virginia.

Collections.—U. S. National Museum, Johns Hopkins University.

^a Saporta, Flora Foss. Portugal, 1894, p. 161, pl. 28, figs. 5, 5a.

ACROSTICHOPTERIS ADIANTIFOLIA (Fontaine).

Baieropsis adiantifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 211, pl. 92, figs. 8, 9; pl. 93, figs. 1-3; pl. 94, figs. 2, 3.—FONTAINE, in WARD, 19th Ann. Rept. U. S. Geol. Surv., 1899, pt. 2, p. 684, pl. 168, fig. 8.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 510, 528, 538.

Description.—The original description by Fontaine in 1890 is as follows:

Stems moderately strong; leaves subopposite to opposite, closely placed, often imbricated, subquadrilateral to flabellate fan-shaped, narrowed to a wedge-shaped base, and attached by a short pedicel which springs from the lower corner of the leaf, so that the inner margin of the leaves runs close to the main stem, parallel with it, and often overlapping it, while the lower margin of the leaves stands nearly at right angles with the main stem; leaves cut down to near the base into two principal laciniae, and those higher cut into two or more minor laciniae; ultimate laciniae very shallow and strap-shaped, ending in acute very short teeth, or rarely in narrowly elliptical and subacute ones; all the laciniae turned outwards or upwards, the lower margins of the leaves being entire or having sometimes an acute tooth; leaves in ascending towards the tips of the leafy branches have their lower margins directed more and more upwards, become smaller, assume more of an elliptical or a wedge shape, have the laciniae only on the upper margin, and finally coalesce to form a terminal leaflet, which at base shows three segments, but whose terminal portions are not seen; nerves fine but distinct, branching at base from a mother nerve and then dividing repeatedly in a dichotomous manner so as to fill the laminae, and have the branches ending in the teeth.

The plant is most frequent at Fredericksburg but is not abundant there, and is usually in a very fragmentary state. If we look to the shape of the leaves alone this curious plant is much like a fern of the type of *Adiantum*, but the gradations through different forms connect the specimens so closely with the flabellate leaves of *Baieropsis* that they can not be separated by any good distinctions. The principal difference from the more common and typical forms of *Baieropsis* is found in the greater proportional width of the leaves and the smaller depth of the subdivision.

This species is based upon very fragmentary specimens and it is very doubtful if the material identified from the Patapsco and Arundel formations is the same as that from the Patuxent, the presence of this species from Chinkapin Hollow, Virginia, and Arlington and Fort Foote, Maryland, being each based on a single very poor specimen.

Occurrence.—LAKOTA FORMATION. Barrett and Hay Creek, Wyoming.—PATUXENT FORMATION. Fredericksburg, Potomac Run, Telegraph Station, Virginia.—PATAPSCO FORMATION. Fort Foote, (?) Maryland and Chinkapin Hollow, (?), Virginia.—ARUNDEL FORMATION. Arlington, (?) Maryland.

Collections.—U. S. National Museum.

ACROSTICHOPTERIS CYCLOPTEROIDES Fontaine emend.

Acrostichopteris cyclopteroides FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 109, pl. 94, fig. 8.

Baieropsis denticulata FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 210, pl. 93, fig. 7.

Description.—Pinnules rounded, fan-shaped, cyclopteroid, divided into two or three principal segments which are split up into six or more subordinate linear oblong divisions terminated by subacute teeth. Rachis stout. Venation flabellate, the single vein which enters the base repeatedly forking dichotomously, the ultimate divisions entering the teeth.

This species is poorly characterized and is based upon infrequent and very fragmentary material from the single locality cited. It may well represent a slightly variable form of pinnule of one of the other more abundant Patuxent species, as, for instance, *Acrostichopteris parvifolia* Fontaine. In the foreign Cretaceous it is rather remotely suggestive of *Sphenopteris flabellina* Saporta^a from the Albien of Portugal.

Occurrence.—PATUXENT FORMATION. Dutch Gap, Virginia.

Collections.—U. S. National Museum.

ACROSTICHOPTERIS PARVIFOLIA Fontaine emend.

Acrostichopteris parvifolia FONTAINE, (part), Monogr. U. S. Geol. Surv., No. 15, 1890, p. 108, pl. 94, figs. 5, 9, 10, 12; pl. 171, figs. 3, 4; pl. 172, fig. 4 (not Fontaine, in Ward, 1906).

Acrostichopteris densifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, pl. 94, fig. 4 (not balance of figures).

Baieropsis adiantifolia minor FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 212, pl. 94, fig. 1.

Acrostichopteris parcelobata FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 108, pl. 94, figs. 6, 7, 11, 14.

Description.—Pinnules small and generally remote, the distal ones short, all divided into three principal lobes, which are variously dissected and terminated with two or more short stout teeth. Venation, as usual in this genus.

This species is thus far confined to the Patuxent formation of Virginia, the specimens from Maryland so identified by Fontaine proving to belong to *Acrostichopteris longipennis*, which is somewhat similar in appearance but usually much more dense in habit.

The remains are rare and fragmentary at all of the recorded localities except Dutch Gap Canal, where they are not infrequent. They show no traces of fructifications. This species is very closely related to *Acrostichopteris fimbriata* Knowlton^b of the Kootenai formation of

^a Saporta, Flora Foss. Portugal, 1894, p. 160, pl. 28, figs. 3, 6.

^b Knowlton, Smiths. Misc. Coll., vol. 50, 1907, p. 110, pl. 11, figs. 3, 3a.

Montana, and likewise to *Acrostichopteris ruffordi* Seward^a of the English Wealden. On the continent it is represented by the nearly allied and strictly congeneric species *Sphenopteris tenellisecta* Saporta^b from the Upper Jurassic, and *Sphenopteris flabellisecta* Saporta^c from the Aptien of Portugal.

Occurrence.—PATUXENT FORMATION. Dutch Gap, Fredericksburg, Trents Reach, Potomac Run, Virginia (not Federal Hill, Maryland).

Collections.—U. S. National Museum.

ACROSTICHOPTERIS PLURIPARTITA (Fontaine).

Baieropsis pluripartita FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 208, pl. 89, fig. 4; pl. 90, figs. 2-5; pl. 91, figs. 1, 3, 4, 7; pl. 92, figs. 1, 2, 6.—? FONTAINE, in WARD, 19th Ann. Rept. U. S. Geol. Surv., pt. 2, 1899, p. 685, pl. 168, figs. 9-12.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 479, 481, 482, 505, pl. 107, fig. 1.

Baieropsis pluripartita minor FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 208, pl. 91, fig. 5; pl. 92, figs. 3, 4.

Baieropsis longifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 210, pl. 91, fig. 6.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 505, 517, pl. 111, fig. 3.

Description.—Pinnules large in size, inequilateral, fan-shaped, subopposite, at an acute angle of divergence, narrowly divided almost to the base into three principal and a varying number of narrow linear subordinate segments. Venation of the usual character in this genus, slender but distinct. The apices are usually, if not always, broken off, so that their character can not be made out. Rachis comparatively slender.

This species includes the various indefinite fertile specimens upon which Fontaine based the characters of the supposed fruits in his genus *Baieropsis*. These are clearly to be correlated with *Acrostichopteris pluripartita*, since one specimen shows a characteristic pinnule of this species. The preservation is poor, and the most that can be made out are oval bodies apparently representing reduced or transformed segments of pinnules, all the segments of which are fertile in this case and not merely the basal ones, as is shown in so many specimens of *Acrostichopteris longipennis*. Fertile specimens of the present species are, on the other hand, very rare and fragmentary.

This species is present in both the Patuxent and Patapsco formations of Maryland and Virginia. It is also recorded somewhat doubtfully from both the Lakota and Fuson formations in the Black Hills Rim of Wyoming. In Portugal Saporta describes several very similar forms. These include *Sphenopteris cuneifida* of the Urgonien-Aptien^d

^a Seward, Wealden Flora, pt. 1, 1894, p. 61, pl. 6, fig. 3.

^b Saporta, Flora Foss. Portugal, 1904, p. 25, pl. 13, fig. 1.

^c Idem, p. 69, pl. 15, figs. 14, 15.

^d Idem, pp. 69, 127, pl. 16, fig. 11, pl. 23, fig. 5.

Sphenopteris dissectiformis^a of the Aptien (?), *Sphenopteris tenuifissa*^b of the Albien and *Sphenopteris flabellina*,^c also of the Albien.

Occurrence.—PATUXENT FORMATION. Fredericksburg, Trents Reach, Dutch Gap, Virginia; New Reservoir, District of Columbia.—PATAPSCO FORMATION. Hell Hole, 72d milepost, near Brooke, Virginia. (?) Overlook Inn, Maryland.—LAKOTA FORMATION. Barrett, Wyoming.—FUSON FORMATION. Pine Creek, Wyoming.

Collections.—U. S. National Museum.

THE GENUS TAENIOPTERIS OF BRONGNIART.

Brongniart gives the following diagnosis of *Taeniopteris* in his *Prodrome*:^d

Fronde simple, entière, étroite, à bords parallèles, transversée par une nervure moyenne, forte, épaisse, qui s'étend jusqu'à l'extrémité; nervures secondaires presque simples ou bifurquées à la base, presque perpendiculaires sur la nervure moyenne.

The type was the Jurassic species *Taeniopteris vittata*; which was compared with *Danaea* and *Angiopteris* of the modern Marattiaceæ.

This diagnosis is repeated in Latin without material change in the *Histoire*.^e In a later work the same author institutes various comparisons with modern ferns, and points out that the genus probably includes forms of diverse botanical affinities. Three groups are recognized: (1) Those with simple fronds like *Taeniopteris vittata*, which suggests modern forms of *Acrostichum*, (2) those with pinnate or bipinnate fronds with articulated pinnæ like *T. münsteri*, which Brongniart is positive is a member of the Marattiaceæ, and (3) those with nonarticulate pinnate fronds like *T. bertrandi*.

The genus has been ably discussed in its Mesozoic aspects by Saporta, Zingo, Schenk, Schimper, Seward, and other authors, the former especially, while following Brongniart's original characterization of fronds usually simple, considerably extends his diagnosis.^f Saporta's diagnosis is quoted in a recent work by Seward^g and need not be repeated. The latter author uses the genus in a wide sense following Nathorst in including under it such other genera as *Oleandridium*, *Angiopteridium*, *Marattiopsis*, *Danaeopsis*, etc., in which the evidence of relationship seems insufficient for the use of names implying affinity with the respective modern genera. His characterization may be quoted with profit: "Frond simple or pinnate, usually lanceolate or

^a Saporta, *Flora Foss. Portugal*, 1894, p. 68, pl. 15, fig. 18; pl. 16, figs. 22, 23.

^b Idem, p. 161, pl. 28, fig. 4.

^c Idem, p. 160, pl. 29, fig. 16.

^d *Prodrome*, 1828, p. 61.

^e Brongniart *Hist. végét. foss.*, 1831, p. 262.

^f Brongniart, *Tableau*, 1849, p. 21.

^g Saporta, *Pl. Jurass.*, vol. 1, 1873, p. 430.

^h Seward, *Wealden Flora*, pt. 1, 1894, p. 122.

linear-lanceolate, apex acute or occasionally obtusely terminated; a well-marked midrib from which lateral veins are given off either at right angles or more or less obliquely; these may be unbranched or acutely forked as they pass toward the leaf margin."^a The relation of the simple species to those with pinnate fronds is uncertain, although it seems probable that they all belong to the same stock. It proves to be an almost impossible task in the absence of any but the best preserved material to distinguish between *Tæniopteris*-like forms and the remains of such a cycadaceous genus as *Nilsonia*. The lateral attachment of the lamina in the former and its superior attachment in the latter are characters which are very often obscured in the process of fossilization and the usual segmentation of the *Nilsonia* fronds is also a character which is not constant.

The genus is abundant in the late Paleozoic, the Paleozoic forms having been discussed by Zeiller, White, and others, the latter author pointing out^b their probable filiation with the *Megalopteris* stock, which extends back to the Middle Devonian. Species of *Tæniopteris* are abundant during the Mesozoic and occasional occurrences are recorded during the Cenozoic. It may be seriously questioned, however, whether the Paleozoic and post-Paleozoic *Tæniopterids* belong to the same stock.

In the Potomac group several species have been described under the genus *Angiopteridium* which it has seemed best to refer to *Tæniopteris* in the absence of all traces of fructification and the consequent lack of certainty regarding their taxonomic position. Species also occur in the Shasta beds of California and probably in the Kootenai of Montana and British Columbia. It is also a common type in the European Wealden.

Regarding the botanical affinity of the various forms of *Tæniopteris* it seems very probable that the bulk of them are closely related to the Marattiaceæ, a family with which they are allied by nearly all of the authors mentioned. In fact most authors ally them directly with living genera, thus Schimper^c positively refers the Rhætic species *Tæniopteris münsteri* to the modern genus *Marattia*, a conclusion which it is difficult to dispute after seeing the magnificent fruiting specimens figured by this author. Schenk,^d on the other hand, thinks this species is closest to *Angiopteris*, while Raceborski, from the study of fruiting specimens from Poland, which he identifies with this same species, is equally sure of the correctness of Schimper's conclusions. To mention one or two other instances, Schenk^e is sure that *Danaeopsis*

^a Seward, Wealden Flora, pt. 1, 1894, p. 124.

^b White, Bull. Geol. Soc. Amer., vol. 4, 1893, pp. 119-132.

^c Schimper in Zittel's Handbuch, 1890, p. 85.

^d Schenk, Die foss. Pflanzenreste, 1888, p. 30.

^e Idem, p. 35.

marantacea (Presl) Heer from the Keuper is a true *Danaea* and it would be equally difficult to point out the differences between the modern species and the forms of *Danaea* which Zingo describes from the Jurassic of northern Italy.^a

TENIOPTERIS AURICULATUM (Fontaine).

Angiopteridium auriculatum FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 113, pl. 7, figs. 8-11; pl. 28, fig. 1.

Description.—Fontaine's original description is as follows:

Frond pinnate; pinnules thick and leathery, long linear, subacute, remotely placed, free to the base, auriculate at base, attached by the midrib alone; auricles of the bases of the pinnules overlapping the upper surface more or less; midrib of pinnules rather stout and rigid; lateral nerves often obscurely shown, fasciculate or bifurcate, and toward the tips simply forked.

The plant is rare at each locality, but is most common at Fredericksburg. It is something like *Pteris longipennis* Heer^b but there is no reason to think that it is a *Pteris*. It also resembles *Pecopteris salicifolia*^c Oldham and Morris. The forms figured in figs. 8, 9, 11 occur at Fredericksburg; fig. 10 occurs at the locality near Potomac Run. This is different from the others in the great length of the pinnules and in the fasciculate nerves, which are bifurcate, with the branches again forking near their tips. The nerves are obscure on the upper surface of the pinnules. The main rachis is stout and keeled on the under surface, as is shown in fig. 9. On the upper surface the auricles at the base of the pinnules overlap more or less the surface of the main rachis.

No new material referable to this species has been collected.

Occurrence.—PATUXENT FORMATION. Fredericksburg and Potomac Run, Virginia.

Collections.—U. S. National Museum.

TENIOPTERIS NERVOSUM (Fontaine).

Angiopteridium nervosum FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 114, pl. 29, fig. 2.

Angiopteridium densinerve FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 115, pl. 29, fig. 4.

Angiopteridium pachyphyllum FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 115, pl. 29, fig. 5.

Angiopteridium strictinerve FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 116, pl. 29, figs. 8, 9 (not Fontaine in Ward, 1906).

Angiopteridium strictinerve latifolium FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 116, pl. 30, figs. 1, 5—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, p. 241, pl. 66, figs. 8-10.

Anomozamites angustifolius FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 167, pl. 30, fig. 3 (not fig. 2).

Anomozamites virginicus FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 168, pl. 30, fig. 4; pl. 31, fig. 3.

Description.—Habit unknown, although there are indications in one or two specimens that the frond was pinnate. Pinnæ (or frond)

^a Zingo, Flora Foss. Oolith., vol. 1, 1856.

^b Heer, Foss. Flora Arct., vol. 6, pt. 2, pl. 10, figs. 5-13.

^c Foss. Flora of the Rajmahal series, pl. 27, fig. 2.

linear-lanceolate to elongate-lanceolate. Length unknown, apparently ranging from 10 cm. to 30 cm. Maximum width 1.2 cm. to 5 cm. Texture coriaceous. Midrib rather stout and prominent. Lateral veins thin but distinct, especially on the lower surface, more or less closely placed, parallel, curving backward from the midrib and then straight or slightly curved upward to the margin. Angle of divergence wide, 45° to 90° . Veins either simple or forked, the forking usually near the base, both kinds often shown on a single specimen.

This species is based entirely upon very fragmentary material, which served Fontaine for the differentiation of five species of *Angiopteridium* and two species of *Anomozamites*. There is absolutely no ground for the reference of any of the material to the genus *Anomozamites* and it is all obviously identical. There is some slight variation from specimen to specimen, for example, the midrib is somewhat less stout in *Angiopteridium nervosum* and *densinerve* as delimited by Fontaine and the angle of divergence is somewhat more acute in the latter, but these are not characters of specific value. If similar recent fronds, such as those of *Oleandra*, *Angiopteris*, or *Marattia*, be examined the size of the midrib, the remoteness or closeness of the lateral veins and their angle of divergence will be found to vary through much wider limits, a single frond often exhibiting the extremes in this respect.

A single specimen from Fredericksburg, figured by Fontaine ^a and showing apparently the basal portion of three pinnæ lying in the same plane and direction and two of them attached to stout bits of rachis, is the only evidence that the fronds were pinnate and not simple. These may represent aerial stalks or they may equally well be interpreted as fragments of a rhizome or a rootstock.

This species is not common in the Potomac group and is confined to the Patuxent formation. Similar remains are described from both the Knoxville and Horsetown beds of the Pacific coast and similar fragmentary specimens are described by Saporta ^b from the Valanginien of Portugal and referred to Schimper's genus *Oleandridium*. In the European Wealden there is *Oleandridium beyrichii* Schenk ^c from Germany and England which Seward refers to *Tæniopteris*, and two other forms of questionable distinctness which the latter author describes from the English beds.^d *Oleandra arctica* Heer ^e from the Kome beds of Greenland may be compared with the Potomac *Tæniopterids*. Newberry ^f identifies this species in the

^a Monogr. U. S. Geol. Surv., No. 15, 1890, pl. 29, fig. 9.

^b Saporta, Flora Foss. Portugal, 1894, p. 85, pl. 15, fig. 3; pl. 16, fig. 18.

^c Schenk, Palaeontographica, vol. 19, 1871, p. 221, pl. 29, figs. 6, 7.

^d Seward, Wealden Flora, pt. 1, 1894, pp. 127, 128.

^e Heer, Flora Foss. Arct., vol. 3, pt. 2, 1874, p. 38, pl. 12, figs. 3-11.

^f Newberry, Amer. Journ. Sci. (ser. 3), vol. 41, 1891, p. 201, pl. 14, fig. 9.

Kootenai of Montana, the latter forms at least, being probably identical with the Virginia species.

Occurrence.—PATUXENT FORMATION. Fredericksburg, near Telegraph station and near Potomac Run, Virginia.

Collections.—U. S. National Museum.

THE GENUS NILSONIA OF BRONGNIART.

This genus was founded by Brongniart ^a for certain remains from the Rhætic of Sweden which had been recorded and figured by Nilsson in 1820 who regarded them as fern remains. In the *Prodrome* the diagnosis is as follows:

Feuilles pinnées; pinnules rapprochées, oblongues, plus ou moins alongées, arrondies au sommet, adhérentes au rachis par toute la largeur de leur base, à nervures parallèles, dont quelques-unes sont beaucoup plus marquées. ^b

The genus was regarded by Brongniart as referable to the Cycadales a view generally accepted by subsequent workers, although Schenk^c in 1867, on the basis of supposed sori on some German specimens, referred it to the Filicales, in which he was at first followed by Schimper^d and more recently by Solms-Laubach.^e

The genus has also been ably discussed by Saprota, Nathorst, Seward, and others, Nathorst in particular having shown that the two kinds of veins supposed to occur together were due to slight folds in the lamina due to pressure, maceration, or the creep of the enclosing strata. He characterizes the veins as equal and simple and emphasizes the insertion of the lamina on the upper surface of the rachis, suggesting that Schenk's supposed sori are fungal or stomatal in their nature.^f

The genus may be redefined in the following terms: Frond coriaceous, elongate-lanceolate in outline, entire or commonly more or less deeply pinnatifid by being split, usually to the rachis, into a number of more or less irregular segments which are contiguous, usually broad, and truncate. Lamina attached to the upper surface of the rachis, the simple and parallel equal lateral veins running almost or quite to the median line. In material showing only the under surface of the fronds the stout midrib is prominent and unsegmented specimens are scarcely distinguishable from *Tæniopteris* and allied forms, while the segmented varieties approach *Anomozamites* or even some species of *Pterophyllum* in appearance.

^a Ann. Sci. Nat., vol. 4, 1825, p. 218.

^b Brongniart, *Prodrome*, 1828, p. 95.

^c Schenk, *Die fossile Flora Grenzsichten Keupers u. Lias Frankens*, 1867, p. 124.

^d Schimper, *Pal. Végét.*, vol. 1, 1869, p. 488.

^e Solms-Laubach, *Fossil, Botany*, 1891, p. 139.

^f See Nathorst, *Über die gattung Nilsonia Brongn.*, *Kongl. Svenska Vet. akad. Handl.*, vol. 43, 1909, No. 12.

The genus *Nilsonia* appears in the Triassic and is particularly a Rhætic and Oolitic type. A number of undoubted species occur, however, in the Lower Cretaceous, no less than seven different species having been recorded from the Lakota, Kootenai, and Shasta deposits. The Neocomien of Japan furnishes two or three species, while the widespread *Nilsonia schauinsburgensis* (Dunker) Nathorst, occurs very abundantly at a number of European Wealden localities. The Upper Cretaceous shows a species in the Atane beds of Greenland and one in the Cenomanien of Bohemia, while several supposed species have been recorded from Tertiary strata.

There are two species in the Potomac group, a lanceolate unsegmented form variously described by Fontaine as *Angiopteridium* and *Sapindopsis* and the large and elegant form which this author describes as two species of *Platypterygium*. The latter term was proposed by Schimper in 1880 as a subgenus of *Anomozamites* for very large forms of that type. It was subsequently used as a genus by Feistmantel and Fontaine although this usage seems unwarranted, especially since the *Platypterygium* forms of *Anomozamites* are all confined to much older horizons and the Potomac forms agree in all essential characters with *Nilsonia*, a relationship suggested by Seward in 1900 after examining the material in the U. S. National Museum. As illustrated by Fontaine the rachis is represented as very wide and the opposite segments are far apart. That the midrib was not wide and flat in life, but prominent below and not out of proportion to the size of the fronds is shown by a most casual examination of the considerably macerated and much flattened specimens.

NILSONIA OREGONENSIS (Fontaine).

Angiopteridium strictinerve FONTAINE, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 240, 511, pl. 66, figs. 5-7; pl. 110, fig. 12 (not Fontaine, 1890).

Sapindopsis oregonensis FONTAINE, Monogr. U. S. Geol. Surv., No. 48, 1905, p. 268, pl. 69, figs. 15-17.

Description.—Frond simple, unsegmented in all the specimens collected, lanceolate in outline, with equally pointed apex and base. Length apparently about 7 cm. to 15 cm. and greatest width, which is midway between the apex and the base, 1.2 cm. to 1.6 cm. Texture coriaceous. Rachis stout, prominent below. Lateral veins close and parallel, the great majority simple, but an occasional vein forking dichotomously. Angle of divergence large, varying from 55° in the apical part of the frond to 85° in the median and basal portions.

This species is based upon considerable incomplete material from widely separated localities, which afforded the basis for two different species of Fontaine, but which seem to be identical and markedly different from the types to which they were referred. The forms

referred to, *Angiopteridium strictinerve*, are from Virginia and California, while those described as a new species of *Sapindopsis*, which genus they do not resemble in the remotest degree, are from Oregon. The former are quite different from the type of that species, being smaller and less elongate with closer mostly simple veins and with the rachis prominent below and masked above by the lamina of the frond. The latter correspond with the others in outline and venation, differing in outline, venation, and in the character of the rachis from *Sapindopsis*.

The present species, which is confined to the Potomac group and the Shasta of California and Oregon, where it occurs in both the Knoxville and the Horsetown beds, is suggestive of the species from the Neocomien of Japan, which Yokoyama^a identifies as *Nilsonia johnstrupi* Heer.

Occurrence.—PATUXENT FORMATION (?) Chinkapin Hollow, Virginia.—SHASTA FORMATION, California (Tehama County, in Knoxville and Horsetown beds), and Oregon (near Riddles, in Horsetown beds).

NILSONIA DENSINERVE (Fontaine).

Platypterigium densinerve FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 169, pl. 30, fig. 8; pl. 31, figs. 1, 4; pl. 32, figs. 1, 2; pl. 33, fig. 1; pl. 34, fig. 1; pl. 35, figs. 1, 2.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, p. 521, pl. 112, fig. 8.

Platypterigium rogersianum FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 171, pl. 31, fig. 2; pl. 33, fig. 2; pl. 34, fig. 2.

Description.—Fronds large, upward of 50 cm. to 70 cm. in length by 15 cm. to 18 cm. in greatest width, averaging about 12 cm., either entire or more often irregularly divided into rectangular or subrhombic segments, at times somewhat rounded proximad. Texture coriaceous. Rachis stout, prominent below, more or less flattened during fossilization. Laterals of small calibre, close, one-third to 1 mm. apart, parallel, invariably simple and nearly straight, diverging at an angle in the neighborhood of 90°.

This splendid species, presumably because of its large size, is represented only by fragmentary specimens, both the apex and the base being missing. It is not at all common and is entirely confined to the Patuxent and Arundel formations in the Maryland-Virginia area. The specimens show some individual variations in the degree of segmentation and strength and position of the lateral veins, the forms which served as a basis for *Platypterigium rogersianum* of Fontaine, being more robust, but somewhat smaller than the others, with veins somewhat larger in size and less closely placed, but the limits of variation are nevertheless quite restricted.

There can be but little doubt of all of these forms belonging to a single species, such variations as are observable being due to varia-

^a Yokoyama, Journ. Imp. Coll. Sci., Japan, vol. 7, 1895, p. 226, pl. 25, figs. 1-4.

tions in the methods of preservation. At first glance the rachis appears to have been wide and ribbon-like, but this was not the case. The segments are inserted on the upper surface of the rachis in conformity with the generic diagnosis, and in one of the specimens the lateral veins of opposite sides approach to within 1 mm. of each other, being separated by a slightly raised ridge. Ventrally it is seen that the large rachis is flattened and during or since fossilization small fragments of the inner margin of the segments overlying the rachis are more or less flaked off, exposing in places the broadly flattened rachis. In another specimen the segments of one side are still attached centrally to the top of the rachis, which is flattened and pushed over in the opposite direction, the segments of the other side being broken off proximally, again giving the appearance of a broad, flat rachis. In the final report the writer will show photographic reproductions of a number of these forms with cross-sections illustrating the manner of fossilization, and showing conclusively the correctness of the foregoing statements.

Occurrence.—PATUXENT FORMATION, Fredericksburg, Virginia.—ARUNDEL FORMATION, Langdon, District of Columbia.

Collections.—U. S. National Museum.

THE GENUS SAPINDOPSIS OF FONTAINE.

This curious genus was founded by Fontaine^a in 1890, and referred to the Family Sapindaceæ of the Order Sapindales. It was characterized as follows:

Leaves pinnate, both odd pinnate and abruptly pinnate; terminal leaves usually more or less united at base; upper pairs of leaves decurrent, forming a wing on the common stem, the wing lessening in width on the pairs in descending; leaves mostly opposite in pairs, sometimes subopposite; the lowest pairs lack the wing, and are sometimes short-petioled; leaves thick, with dense and often glossy epidermis, elliptical or lancet-shaped, with a strong prominent midrib, which extends with slight diminution to the tip of the leaf; lateral nerves going off at a large angle, and uniting more or less completely near the margin to form a series of arches; the lateral or primary nerves, as seen on the lower side of the leaves, strong and prominent, but on the upper side, owing to the thickness of the leaves, generally indistinct; the ultimate reticulation is strong, and forms a series of rather large, irregular, polygonal meshes.

Sapindopsis is an important element in the flora of the uppermost member of the Potomac group, the Patapsco formation, to which the genus is exclusively confined, with the single exception that *Sapindopsis variabilis* has been recorded in the nearly homotaxial Fuson formation of Wyoming. No specimens of *Sapindopsis* are known from either the Patuxent or Arundel formations or their equivalents in other parts of North America. It is true that Professor Fontaine described *Sapindopsis cordata* from Fredericksburg, Virginia, but this

^a Fontaine, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 296.

material, which is very poor, is obviously not related to this genus, while the record of *Sapindopsis elliptica* from Fredericksburg by the same author is based upon the remains of *Rogersia longifolia* Fontaine. Likewise the record of *Sapindopsis obtusifolia* from Deep Bottom, Virginia, is based upon fragments of uncertain generic affinity, but doubtfully related to *Sapindopsis*. The genus is notably absent from the fossiliferous Patapsco beds at Federal Hill, Maryland, but when present at a locality it usually occurs in the greatest abundance, as at Fort Foote, Maryland, or in the vicinity of Brooke and Aquia Creek, Virginia, where hundreds of specimens often of great perfection have been collected.

In modification of the diagnosis quoted above it may be said that the vast majority of the leaves are abruptly pinnate and the terminal leaflets, while usually confluent and decurrent, are sometimes petiolate, *Sapindopsis magnifolia* in particular furnishing many individuals lacking the decurrently winged rachis.

The most closely related plants to *Sapindopsis* in the modern flora are the various genera of American Tropical Sapindaceæ. Among these the genus *Matayba* Aublet approaches very near to the Cretaceous form. *Matayba* embraces species with both opposite and alternate leaflets having either entire or dentate margins. The rachis lacks definite alæ, but it is somewhat flattened with a vestigial wing on each side in the form of a raised line which is wider at the point of origin of the leaflets and decurrent to the next lower leaflets. So many other genera of the Sapindaceæ have markedly alate rachises that the presumption is strong that this genus or its ancestors were at some time similarly provided. The most similar species seems to be *Matayba apetala* (Macfarland) Radlkofer, in which the leaflets are usually more numerous than in *Sapindopsis*; although some specimens show but three pairs, those with four pairs are common; they are sometimes subopposite, and as many as seven pairs are met with. The venation is exactly like that of the fossils, as is the texture of the leaves and their limits of variation. Another closely related species is *Matayba domingensis* Radlkofer, also a native of the West Indies.

It is exceedingly satisfactory to be able to establish upon a somewhat firmer basis Professor Fontaine's choice of the term *Sapindopsis* for these Potomac plants. They are so abundant in their occurrence, so striking in appearance, their strict habit and glossy texture giving them every appearance of some fern-like plant, as, for example, the common *Acrostichum aureum* of the Tropics, that their original describer deserves great credit for having correctly determined their modern affinities.

SAPINDOPSIS VARIABILIS Fontaine emend.

Sapindopsis variabilis FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 298, pl. 151, fig. 1; pl. 152, figs. 1, 4; pl. 153, fig. 3; pl. 154, figs. 2-4; pl. 155, figs. 2-5.—FONTAINE, in WARD, 19th Ann. Rept. U. S. Geol. Surv., 1899, pt. 2, p. 690, pl. 169, fig. 9; Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 481, 482, 489, 532, pl. 114, fig. 2.

Sapindopsis parvifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 300, pl. 154, fig. 6.

Description.—Leaves odd pinnate, sometimes abruptly pinnate, with three pairs of lateral leaflets, which may be opposite, although usually there is a tendency toward a subopposite arrangement, markedly so in several specimens. Leaflets normally lanceolate, individuals of the same leaf about of a size, usually markedly decurrent, but variable in this respect. The proximal leaflets are always less decurrent than the pair next above, and in some cases even have short petioles. The upper leaflets are remarkably variable, sometimes with an abnormal decurrent wing which joins the inner lamina of the next lower pair of leaflets; at other times the rachis entirely lacks a wing. The leaf may be terminated abruptly by a pair of leaflets variously coalesced or the three apical leaflets may be variously united, their lamina may be almost symmetrical or markedly inequilateral, their margins showing a tendency toward undulation, and occasionally a leaflet is divided into a basal and an apical part by a sharp constriction on one side near the middle of the blade, ranging in size from the small forms upon which Fontaine founded his species *Sapindopsis parvifolia* and which are 1.6 cm. long and 0.4 cm. wide to forms which approach *Sapindopsis magnifolia* in size and are 10 cm. long and 1.5 cm. wide. The average dimensions of a large number of specimens are, however, 6 to 7 cm. long by 1 to 1.3 cm. wide.

Leaves thick, with smooth surface. Rachis and midrib stout. Venation more prominent than in the other species, but still very faint, with the exception of the secondaries, which while fine are more conspicuous than in the other species. Secondaries forming a wide angle with the midrib, nearly straight for two-thirds of the distance to the margin, where they bend sharply upward and join the secondary next above by a but slightly curved arch. As the secondaries are numerous and almost uniformly spaced the venation has much the appearance of a *Eucalyptus*, except that the marginal hem is much broader than in that genus.

This species is exceedingly abundant at various localities in the Patapsco formation and is by far the most characteristic species of that formation, although it has not been detected at certain other undoubted Patapsco horizons. It is the only species of the genus which has been recorded outside of the Maryland-Virginia area, occurring in the Fuson formation along Oak Creek, Wyoming, where

it is the most abundant species found, just as it is at White House Bluff, Brooke, and Aquia Creek, Virginia, and at Fort Foote, Maryland.

It is an exceedingly variable form in all its details, and as during maceration the most variable apical portion is the last to be destroyed this variability is emphasized in fragmentary material such as that usually collected. When well preserved it furnishes most characteristic specimens. In life its rigid pinnate leaves and strict appearance must have given it a very striking aspect.

Occurrence.—PATAPSCO FORMATION. Fort Foote (over 100 specimens), Prince George County, Maryland; near Brooke, White House Bluff, Mount Vernon, 72d milepost, Aquia Creek, and near Wide-water, Virginia.—FUSON FORMATION. Oak Creek, Wyoming (abundant at all of the foregoing localities).

Collections.—U. S. National Museum, Johns Hopkins University.

SAPINDOPSIS MAGNIFOLIA Fontaine emend.

Sapindopsis magnifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 297, pl. 151, figs. 2, 3; pl. 152, figs. 2, 3; pl. 153, fig. 2; pl. 154, figs. 1, 5; pl. 155, fig. 6.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 481, 482, 528.

?*Aralia dubia* FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 314, pl. 157, figs. 1, 7 (not Schimper, 1874).

Ficophyllum eucalyptoides FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 294, pl. 164, figs. 1, 2.

Sapindopsis tenuinervis FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 301, pl. 153, fig. 1.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1906, pp. 489, 528.

?*Aralia fontainei* KNOWLTON, Bull. No. 152, U. S. Geol. Surv., 1898, p. 37.

Sapindopsis obtusifolia FONTAINE, 1890, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 301, pl. 156, fig. 13; pl. 159, figs. 3-6.

Ficophyllum eucalyptoides FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1906, p. 489.

Description.—Leaves commonly odd pinnate, although occasional abruptly pinnate forms occur, of considerable size, but somewhat variable, however, in this respect. Leaflets 3 pairs, comparatively large, lanceolate, tapering almost equally toward the apex and base, the latter inequilateral except in the terminal leaflets, pointed, often lacking apical portions, length increasing proximad, averaging about 10 cm., longest seen 14 cm. (estimated), shortest 5 cm., width varying from 1.1 to 3.2 cm., inequilateral, since the outer half of the lamina is broader than the inner half and is markedly decurrent. This feature is least emphasized in the basal leaves which may even have a considerable petiole, but becomes increasingly pronounced distad, the terminal leaflets often forming a bilobate or trilobate whole with the outer margins broadly decurrent and joining the lamina of the leaflet next below at the point of juncture of its inner margin with

the rachis. Certain specimens show all of the leaflets petiolate, a feature much emphasized in specimens collected recently on Stump Neck, Maryland, in which the petioles are 3 to 4 cm. in length. The leaflets in this species are much oftener petiolate and lacking in the winged rachis than in *Sapindopsis variabilis*, in these features closely resembling the leaves of the modern *Matayba apetala* in which the rachial wings are vestigial. Leaf substance thick and leathery, epidermis firm and glossy.

Leaflets commonly subopposite, often markedly so, forming an acute angle with the rachis. Midribs stout and prominent below. Secondaries slender, only seen on the under surface of the leaflets and even then made out with difficulty, 8 to 10 pairs, branching from the midrib at a rather wide angle especially in the central part of the leaf, the angle is more acute basally, curving upward ultimately to join a short branch of the secondary next above. Tertiaries fine, forming lax subrhombic areolæ where visible.

This species is very common at certain localities within the Patapsco formation, as, for example, on Stump Neck, in Charles County, Maryland, although at other outcrops of this same formation it has not been detected. This is notably the case in the Federal Hill deposits, from which large collections have been made without disclosing a single specimen. Evidently the species was local in its distribution, which is emphasized by its total absence in any other Lower Cretaceous deposit either here or abroad.

The grounds for the separation of this species from *Sapindopsis variabilis* are slight, since both are variable and the larger forms of the latter are quite as large as the smaller forms of *Sapindopsis magnifolia*. In the Potomac they are found in association at all the localities where either occur, and the smaller species is usually the most common as if *Sapindopsis magnifolia* represented the occasional more robust forms of that species. On the other hand, the latter has not been detected in the abundant remains of *Sapindopsis variabilis* found at Oak Creek, Wyoming, and there is commonly considerable disparity in size between the two. There are certain other differences which appear to be constant. These are the thicker relatively longer leaflets of *Sapindopsis magnifolia* with less numerous and somewhat more ascending secondaries which are not connected distally by relatively flat arches. The writer includes under this species the *Sapindopsis tenuinervis* of Fontaine, recorded from the localities near Brooke, Virginia, and from Fort Foote, Maryland. The only apparent ground for its erection was a fancied difference in venation based chiefly on a more slender midrib and more remote leaflets, both characters which are seen to be variable and altogether unreliable as soon as any number of specimens are compared.

The specimen from Deep Bottom, Virginia, which is the most southerly outcrop of the Patapsco formation known and the only one of this age in the James River Valley, forming the basis for the species *Aralia dubia* Fontaine (*Aralia fontainei* Knowlton), is doubtfully included under the synonymy of this species, since it appears to represent a macerated and distorted specimen of the terminal leaflets of a large *Sapindopsis*. There is certainly no ground for retaining it in the genus *Aralia*. Likewise the specimens which formed the basis for *Ficophyllum eucalyptoides* Fontaine are clearly referable to this species of *Sapindopsis* and have nothing in common with *Ficophyllum*.

Occurrence.—PATAPSCO FORMATION. Near Brooke, 72d milepost, near 72d milepost, Deep Bottom (?), near Widewater and Aquia Creek, White House Bluff, Virginia,^a Stump Neck and Fort Foote, Maryland.

Collections.—U. S. National Museum, Johns Hopkins University.

SAPINDOPSIS BREVIFOLIA Fontaine.

Sapindopsis brevifolia FONTAINE, Monogr. U. S. Geol. Surv., No. 15, 1890, p. 300, pl. 153, fig. 4; pl. 155, figs. 1, 7; pl. 163, fig. 3.—FONTAINE, in WARD, Monogr. U. S. Geol. Surv., No. 48, 1905, pp. 481, 482, 528.

Description.—Leaves odd-pinnate, the terminal leaflet considerably larger than the lateral leaflets of which but two pairs are known. These are opposite. Leaflets somewhat crowded, so that their margins often overlap, with subacute tips, varying in length from 2 to 5 cm. and in width from 0.8 to 1.6 cm., averaging about 3 cm. long by 1.3 cm. wide. Inequilateral toward the base and showing considerable variation in decurrence even among the few specimens known, in some the rachis is conspicuously winged, while in others the leaflets are all petioled, the whole having the aspect of some member of the Leguminosæ. Midribs stout, secondaries ascending, camptodrome, seen with difficulty, since the leaf texture is coriaceous.

This is a poorly marked species of infrequent occurrence at the same localities where the other species of this genus occur and may simply represent variant forms of the abundant *Sapindopsis variabilis*.

Occurrence.—PATAPSCO FORMATION. Near Brooke, 72d milepost, Aquia Creek, Virginia; Fort Foote, Maryland.

Collections.—U. S. National Museum, Johns Hopkins University.

^a The table on page 586 of Monogr. 48, U. S. Geol. Surv., gives Colchester road as an additional locality for this species. This occurrence is not mentioned in the text, and the writer has failed to locate the specimen, if one existed, among the fragmentary material from this locality.

DESCRIPTION OF A NEW PARASITIC ISOPOD FROM THE HAWAIIAN ISLANDS.

By HARRIET RICHARDSON,

Collaborator, Division of Marine Invertebrates, U. S. National Museum.

The isopod, which is herein described, was collected by the U. S. Bureau of Fisheries steamer *Albatross* among the Hawaiian Islands in 1902. This species was not included in my earlier report,^a because additional material was sent in after that report was published.

SCYRACEPON HAWAIIENSIS, new species.

Body of adult female oval in outline, somewhat asymmetrical. Color uniformly light yellow.

Head very large, bilobed, and provided with a wide marginal border on the anterior half. Eyes wanting. Both pairs of antennæ

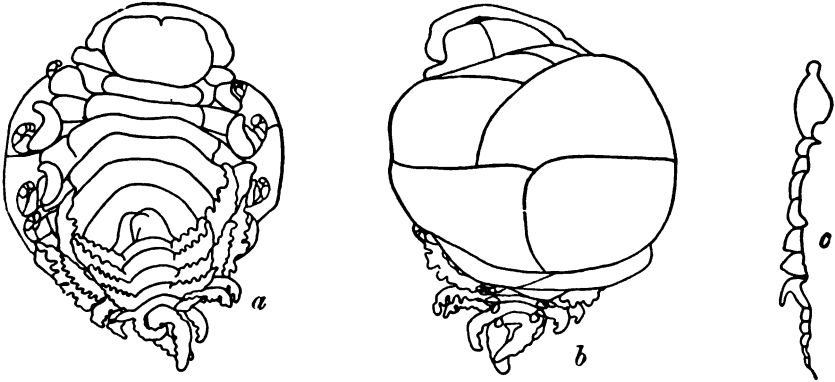


FIG. 1.—SCYRACEPON HAWAIIENSIS, FEMALE. a, DORSAL VIEW. b, VENTRAL VIEW. c, LATERAL VIEW OF THORAX.

small and inconspicuous; first pair composed of two joints; second pair composed of four joints. Maxillipeds very large with the exopodite produced at the inner distal extremity into a long lamella-like process with many smaller lamellæ along its inner margin. The lamella-like process of one side overlaps that of the other maxil-

^a Bull. U. S. Fish Commission, vol. 23, pt. 3, 1906, pp. 819-826.

liped on the ventral side of the frontal border of the head; the endopodite is triangular.



FIG. 2.—SCYTRACAPON HAWAIIENSIS. MAXILLIPED.

All seven thoracic segments are distinct and subequal in length. There is a tendency in all except the first (most marked in the last four) to be produced into a dorsal median boss. This boss is most conspicuous in the seventh segment and takes the form of a strong hook-shaped prominence. The epimera of the first four segments are conspicuous on the anterior portion of the lateral margins. Ovarian bosses are present on the first four segments. The lateral margins of the last three segments are concealed by the overlapping elongated, anteriorly directed "lames pleurales" of the abdominal segments.

The six abdominal segments are distinctly separated on the dorsal side. Each of the first five segments is provided on either side with two elongate, fringed appendages and a small sac-like body on the ventral side at the base of the inferior appendage. The superior elongate appendage on either side of each segment is the "lame pleurale" of the segment, and these decrease in size from the first to the fifth segment, the first being extremely long, the fifth quite small. The inferior elongated branches are the outer branches of the pleopoda and resemble the "lames pleurales."



FIG. 4.—SCYTRACAPON HAWAIIENSIS. FIRST LAMELLA OF MARSUPIUM.

They also decrease in size from the first to the fifth segments. The inner branches of the pleopoda are five pairs of small sac-like bodies, a pair for each segment on the ventral side of the body, inconspicuous, forming two converging longitudinal rows.

The uropoda are a pair of elongated appendages attached to the sixth abdominal segment and resembling the "lames pleurales" and the outer branches of the pleopoda.

There are seven pairs of small, feeble, prehensile legs. There are five pairs of incubatory plates which overlap in the middle of the ventral side, completely inclosing the incubatory pouch. The distal segment of the first pair is somewhat produced at the inner posterior

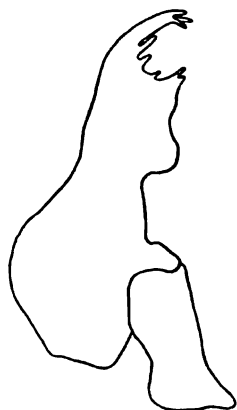


FIG. 3.—SCYTRACAPON HAWAIIENSIS. MANDIBLE.

angle and has the posterior margin drawn out in small lamellæ. The last pair is tuberculate at the base.

The male has all the segments of the thorax defined and distinctly separate. Each is provided with a median ventral boss. The head is small and rounded and provided with eyes. The first pair of antennæ are composed of two articles; the second pair are composed of four articles. The segments of the abdomen are fused in the middle of the dorsal surface, but are indicated laterally by five incisions on either side, the last incision being very slight. The pleopods and uropods are rudimentary.

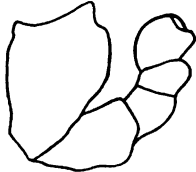


FIG. 5.—SCYRACEPON HAWAIIENSIS. SECOND LEG OF FEMALE.

Two specimens, a male and a female, were collected by the U. S. Bureau of Fisheries steamer *Albatross*, at station 3884, Pailolo Channel, between Maui and Molokai islands, Territory of Hawaii, at a depth of 277 to 284 fathoms in globigerina ooze. They were parasitic on *Pilumnoplax cooki* Rathbun, having been found in the branchial cavity.

Type.—Cat. No. 40897, U.S.N.M.

Only one species of the genus has been previously described, the type, *Scyracepon tuberculosa* Tattersall,^a parasitic on *Scyramathia carpenteri* Norman, and found at Tearaght, County Kerry, Ireland.

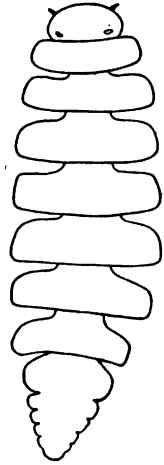


FIG. 6.—SCYRACEPON HAWAIIENSIS. MALE.

^a Fisheries, Ireland, Sci. Invest., 1904, vol. 2 [1905], pp. 36-37, pl. 11, figs. 9-12; p. 78.

FRESH-WATER SPONGES IN THE COLLECTION OF THE UNITED STATES NATIONAL MUSEUM.—PART IV. NOTE ON THE FRESH-WATER SPONGE, *EPHYDATIA JAPONICA*, AND ITS ALLIES.

By NELSON ANNANDALE,
Superintendent of the Indian Museum, Calcutta.

Among the specimens of fresh-water sponges recently sent me by the U. S. National Museum for examination is one of considerable interest from the point of view of geographical distribution. Taken in the Eastern Branch of the Potomac River near Washington, District of Columbia, it evidently represents Hilgendorf's *Spongilla fluviatilis*, var. *japonica*, which, as I have recently pointed out, deserves to rank as a distinct species.

Ephydatia japonica may be distinguished from the *E. fluviatilis* of recent authors by the shortness of its birotulates, which are never much longer than the diameter of their rotules, and by the fact that the indentations on the edge of the rotules are much deeper. From *E. mülleri* (Lieberkühn) it may be distinguished by the smoothness of its skeleton spicules, and from *E. meyeri* (Carter) by the shortness of its birotulates and by the fact that they never form more than a single layer on the gemmule. The following key will demonstrate the most conspicuous characters of these four closely allied species, which are often confused:

I. Skeleton spicules smooth.

- A. Shafts of birotulates much longer than diameter of rotules; rotules not deeply indented; no vesicular cells in the parenchyma.....*E. fluviatilis*.
- B. Shafts of birotulates much longer than diameter of rotules; rotules deeply indented; vesicular cells abundant in the parenchyma.....*E. meyeri*.
- C. Shafts of birotulates not, or at most slightly, longer than diameter of rotules; rotules deeply indented; (?) vesicular cells.....*E. japonica*.

II. Skeleton spicules conspicuously roughened (except at the tips).

- Shafts of birotulates not, or barely, longer than diameter of rotules; rotules deeply indented; vesicular cells abundant in the parenchyma.....*E. mülleri*.

E. fluviatilis occurs all over Europe and North America, in Siberia, Japan, the Malay Archipelago, and Australia; *E. mülleri* all over

North America and Europe and in Japan; *E. meyeri* all over peninsular India from Bombay to Cape Comorin and Calcutta; *E. japonica* not only in Japan but also, as we have seen, in North America.

Unfortunately, none of the specimens of *E. japonica* I have examined are in a sufficiently good state of preservation for me to be able to express an opinion as to whether vesicular cells are present or not. Probably they are not present, for Doctor Weltner, who has examined the type-specimens, regards the form as a variety of *E. fluvialis*.

The following is the synonymy of *E. japonica*, so far as we know it :

- 1882. *Spongilla fluvialis*, var. *japonica* HILGENDORF, Sitzungsber. Ges. Naturf. Freunde, Berlin, p. 26.
- 1895. *Ephydatia fluvialis*, var. *japonica* WELTNER, Archiv f. Naturg., vol. 1, pp. 123, 134.
- 1909. *Ephydatia japonica* ANNANDALE, Annot. Zool. Japon., vol. 7, pt. 2, p. 109, pl. 2, figs. 3, 3a, 3b.

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